TEXTILES PAPER LEATHER

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Including the Proceedings of the
AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME XII FEBRUARY 26, 1923 NUMBER 5

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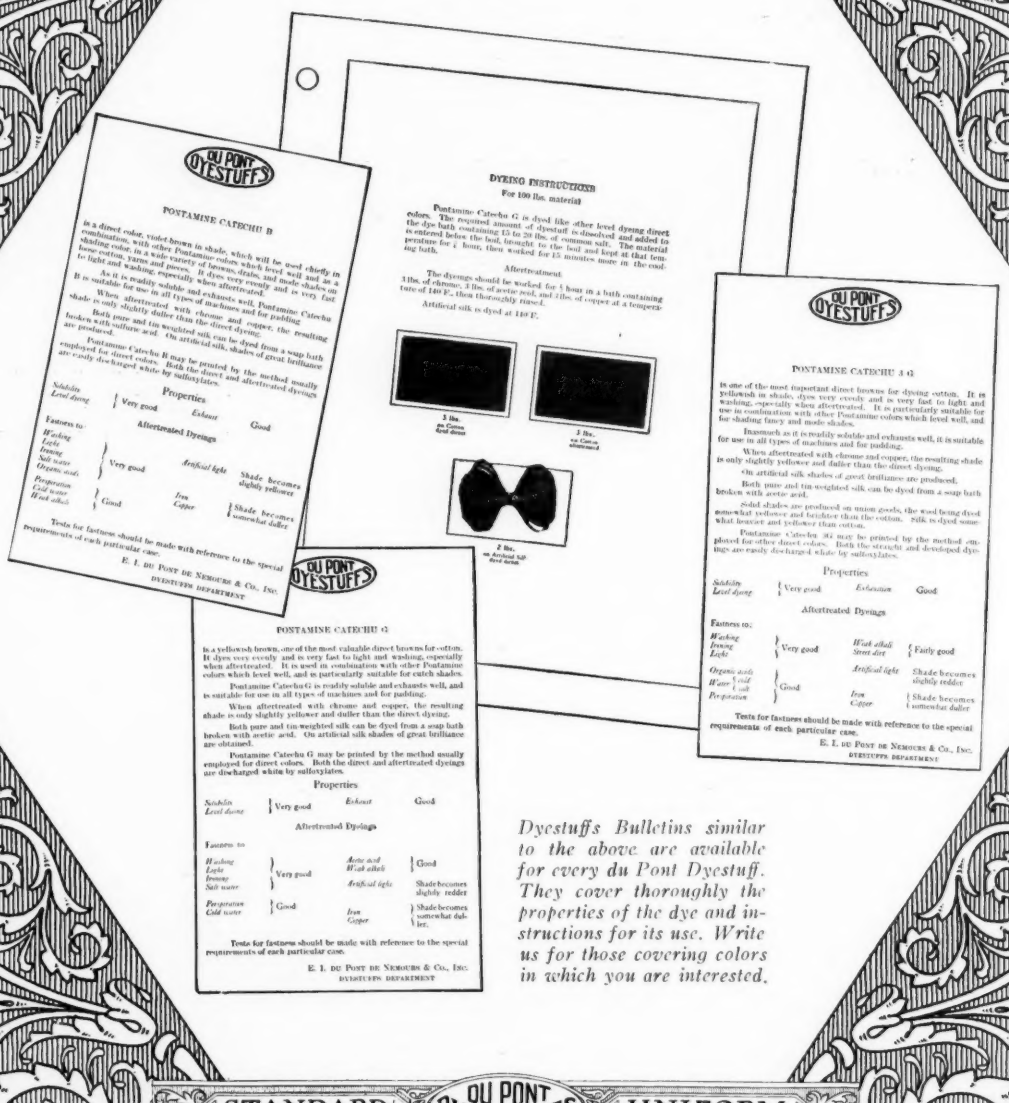

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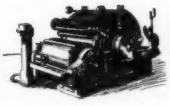

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VOLUME XII NEW YORK, FEBRUARY 26, 1923 NUMBER 5

A History of the Chemistry of the More Important Natural Dyes

Part II

Commercial Logwood Products—Merits of Logwood as a Dyestuff—The Soluble Redwoods—Investigators of Brazilin—Similarity of Brazilin and Hematoxylin—Chemistry of Fustic—Separation of Morin and Maclurin—Properties of Fustin—Osage Orange—Quercitron—Isolation of Quercetrin—Turmeric—Cutch and Gambier

By EMIL LESSER, Ph.D.

American Dyewood Company, New York

Commercial Logwood Products

DEPARTING for the time being from the chemical side of the paper, let us consider the manufacture of commercial logwood products. The history of the dyewood industry in this country dates back to 1798, when William Partridge hitched a horse to a small windlass grinder and cut logwood and fustic into chips for the New England dyers.

But the French were pioneers in manufacturing logwood extract. In 1829 Missonier, a Frenchman, captain of a sailing vessel, who frequently brought logwood from Yucatan, conceived the idea of making extract and built a factory in the outskirts of Paris. It is interesting to chronicle that he used porcelain-lined vessels for concentrating his extract. He evidently had been informed of the danger of metallic contamination of the coloring principle of logwood. Unfortunately, like its inventor, his successors were anything but technical chemists, and it was a sad day for the industry when Chevreul's theses were turned down by the French extract manufacturers. What an opportunity they had for placing the industry on a scientific basis! We wonder what these men would think if they could only see a modern extract plant, where everything is under complete scientific control, from the raw material to the finished product, and if they knew how the technical staffs appreciate the work done by Chevreul.

The mechanical improvements which were made created the possibility of producing large quantities of pure extracts, not only in an economical manner but also of assured standards of quality.

These standards can be created at will and under full control by scientific methods. Instead of being obliged to use the raw material in the form of chipped and aged wood, as in former times, the dyers now find themselves in the position to choose from logwood products, as they are placed on the market in various forms, namely: unoxidized, medium oxidized, high oxidized, in paste form, or in crystals.

In the selection from the above-mentioned standards the dyer will be guided by considerations affecting purely the material on which he desires to produce the best and most economical black. The unoxidized grades of logwood extracts find their principal use on fibers such as cotton, paper and leather of a certain tonnage, whereas the choice of oxidized grades is made for wool in conjunction with a choice of most suitable mordants. In addition to this, there is an important use made of both types for the production of blacks on silk. Logwood not only colors silk but also improves the weight of silk to a great extent. Further important uses of both oxidized and unoxidized extracts are for leather, paper, pigments, inks, hair, wood, ivory, and a number of materials for which a deep black is necessary.

Merits of Logwood as a Dyestuff

As a dyestuff, logwood holds a unique position as a black dye for silk, cotton and leather. On wool and leather its characteristic bloomy blue black has never been equaled by an artificial dyestuff from an economic or any other point of view. In the artificial dyestuff industry it is considered the standard black for purposes of comparison. Even in artificial light it loses none of its wonderful shade, remaining a handsome, solid black. On wool we have been advocating a highly oxidized prod-

uct on a reduced chrome mordant; when dyed under these conditions logwood is the black *par excellence* for fastness to light, milling, etc. The excellent qualities that have been ascribed to logwood on wool can also be applied to leather, whether vegetable or chrome tanned. Before the war, tons of logwood crystals were shipped to the artificial dyestuff plants in Germany, where they were mixed with artificial colors in order to make up any deficiencies in the latter.

Some years ago Meerman and Weidmann discovered a new process of dyeing and weighting silk with logwood which replaced long and tedious processes, and to-day a tremendous quantity of logwood products is used in the silk industry. By various methods silk will absorb as much as twice its own weight of logwood. No artificial dyestuff has yet been discovered that possesses this peculiar and valuable property.

The Soluble Redwoods

We now come to the class of natural dyestuffs which contain the coloring principle brazilin. This class is known as the soluble redwoods, of which there are several varieties:

Brazilwood	Caesalpinia braziliensis
St. Martha wood	Caesalpinia echinata
Pernambuco	Caesalpinia crista
Sapan wood	Caesalpinia sappan
Nicaragua	Caesalpinia

Like logwood, they belong to the class known as Leguminosae. They are all natives of Central and South America with the exception of the Sapan wood, which grows in the warmer parts of Asia. In physical appearance the wood is not unlike logwood. St. Martha wood has a star-like cross-section.

Sapanwood was known many centuries in Europe before the discovery of America. The early explorer Vasco de Gama, on his way to India by sea, discovered it and introduced it into western Europe, but it has only come into extensive use since the introduction of the American varieties. Certain of the above-named woods are used for cabinet work, as they have the excellent property of taking on dead and bright polishes.

The extracts from these woods are known as Hypernic, Limawood, Sapanwood, Brazilwood or Peachwood extracts. The word Hypernic is only common to America, and is supposed to be derived from the first three letters of the name Nicaragua—a superior quality liquor from this wood being called "hyper-Nic."

Investigators of Brazilin

The real coloring matter of the redwood—namely, brazilin, $C_{16}H_{14}O_5$—was isolated by Chevreul (Am. Chem., 66, 225) and investigated with the same thoroughness that he employed in the investigation of Hematoxylin. On account of the great similarity with the chemical reactions of Hematoxylin, he considers both bodies identical. Chevreul evaporated a redwood liquor to dryness, extracted the residue with water, and precipitated the acids with lead hydroxide. The dry filtrate he extracted with alcohol, diluted the alcoholic extraction with some water, and added glue solution to precipitate tannin matters. The remaining liquid was evaporated to dryness and the dry substance extracted with boiling alcohol, out of which the brazilin crystallized. Later, Schutzenberger, Bolley, Kopp, and principally Liebermann and Burg, spent considerable time on the isolation of brazilin. Kopp found that by the dry distillation of brazilin a good yield of resorcin was obtained, and according to his view the following reaction took place:

$$C_{22}H_{18}O_7 + H_2O = C_{16}H_{14}O_6 + C_6H_6O_2$$

thus giving as the formula for brazilin, $C_{22}H_{18}O_7$.

But Liebermann and Burg determined the exact constitution of brazilin—namely, $C_{16}H_{14}O_5$—which formula is used at the present time.

Similarity of Brazilin and Hematoxylin

As previously mentioned, there is a great similarity between brazilin and hematoxylin toward chemical reagents. This induced investigators of both substances to use the simpler and more reactive of the two as a basis for their research work. We find, therefore, that the chemistry of brazilin is practically similar to that of hematoxylin.

No wonder Chevreul believed them to be identical! In spite of all the numerous investigations, the constitution of hematoxylin and brazilin is not fully explained, but all the investigations show that they are related. They are both derived from trees which belong to the same botanical family, Leguminosae.

Liebermann and Burg rightfully say that hematoxylin and brazilin are in the same relation to one another as purpurin and alizarine. Both coloring matters are probably present in the plants as leuco compounds which are transformed by oxidation into the actual hematoxylin and brazilin by the loss of two atoms of hydrogen.

From the work done we come to the conclusion that the two bodies belong to the dihydropyrone group. The coloring matters have an acid character and give, with metallic oxides, colored lakes; and on this fact rests their important tinctorial application.

Much research work has been done regarding the influence of the constitution of a coloring matter on the properties of shade, fastness to light, washing, etc. In brazilin and hematoxylin we find an excellent example of this influence, but the more complicated substance hematoxylin gives a blue and ultimately a black

(Continued on page 185.)

Modern Equipment for Dyeing, Bleaching and Finishing Operations

Best Practice Tends to Utilize Non-Corrosive Materials in Construction of Apparatus and Equipment—Monel Metal in Favor Because of Its Acid and Alkali Resisting Properties—Non-Absorbent Surface Makes Practicable Quick Change of Colors in Same Machines

By E. A. TURNER

The International Nickel Company, New York City

UNTIL recent years the bleacher and dyer had little confidence in metals for general use in contact with the liquids used in their processes. Wooden machinery and cement or concrete tanks and vats found the widest application to the textile dyeing and bleaching fields.

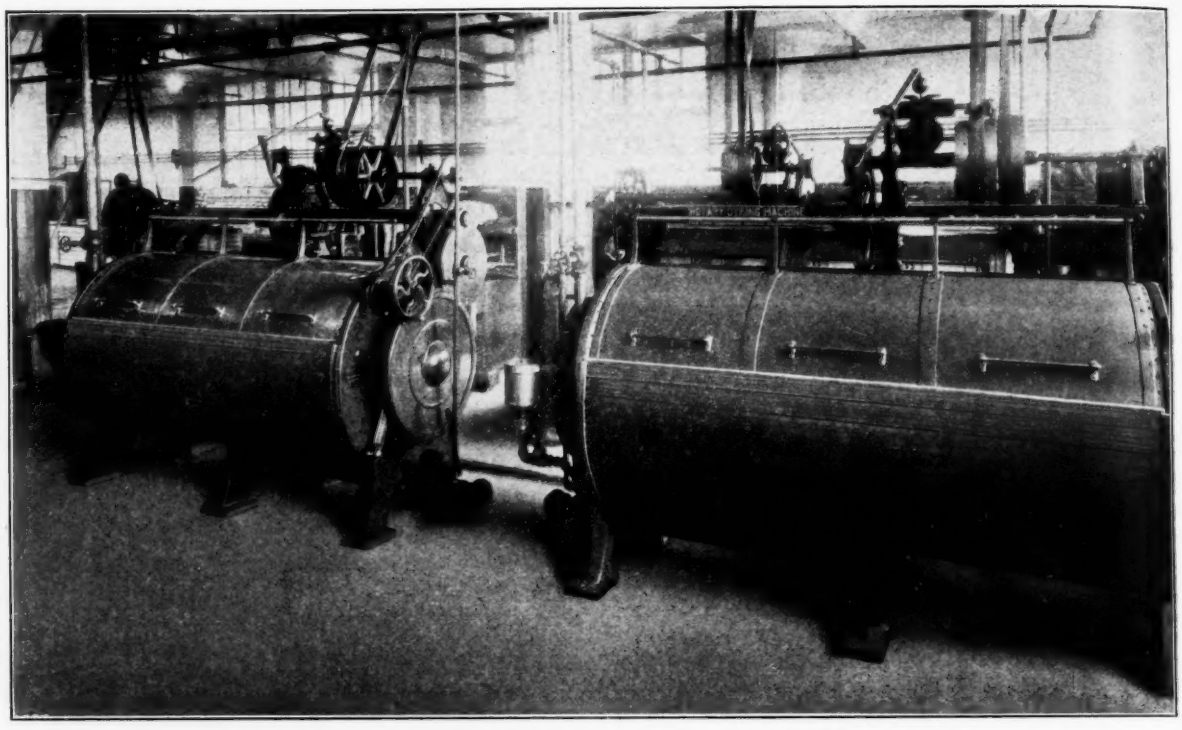
The objection to most metals for general application to corrosion problems was the item of cost, as the acid-resisting metals then known were precious or semi-precious metals. There were certain shades that could not be satisfactorily dyed with the common metals formerly in use, because the metal itself influenced the dyestuff and prevented the securing of the desired shade. Metals then in use did not have sufficient resistance to corrosion to make such equipment a profitable investment for the mill owner.

Monel metal, now widely used, is a corrosion-resisting, silvery-white alloy, as strong as steel and somewhat tougher. By a corrosion-resisting metal we mean one that will stand up under the severe service and action of the various dyestuffs, acids, alkalies, etc., used in the dyehouse and bleachery. Such equipment is lasting to a remarkable degree. In appearance Monel metal resembles nickel, but in its tensile properties it is more nearly allied to the steels. It contains about 67 per cent nickel, 28 per cent copper and 5 per cent other metals, and is mined from the Sudbury copper-nickel ores and refined by The International Nickel Company. The greatly increased demand for this alloy has necessitated the construction of an extensive refinery and electrically operated rolling mill at Huntington, W. Va. Here Monel metal is produced in sheets, plates, rods, and all commercial forms.

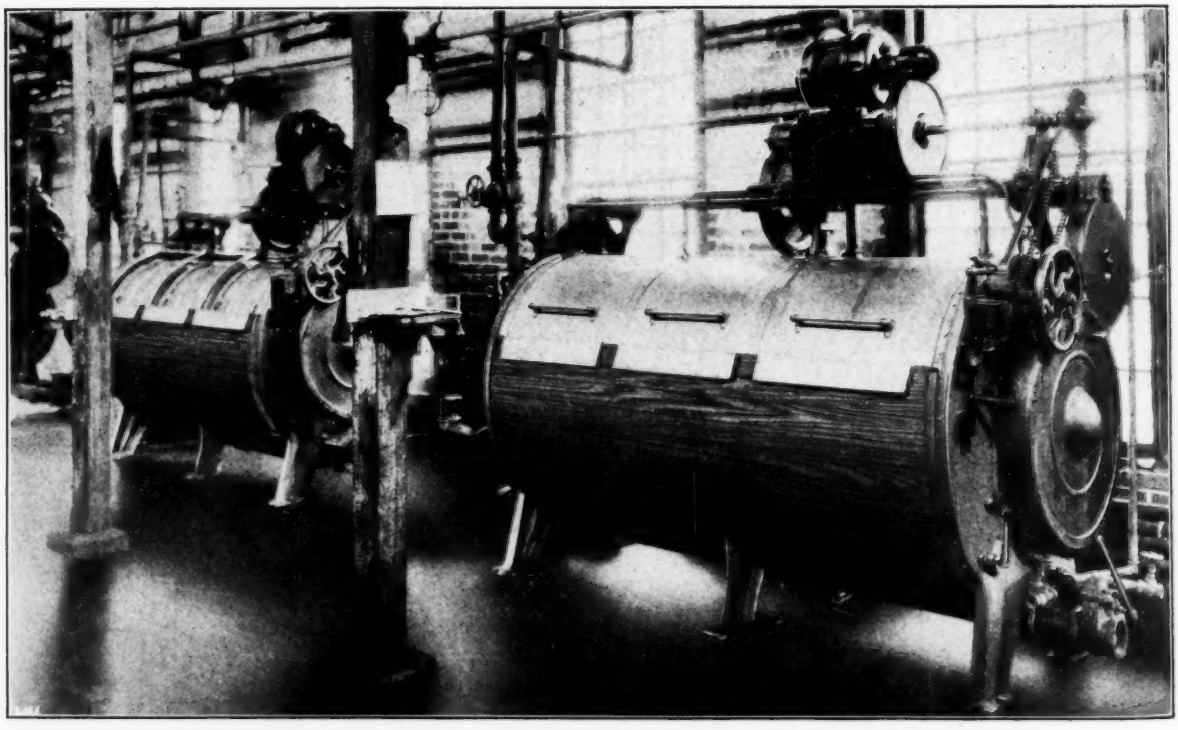
When first placed on the market, Monel metal was received with considerable reservation by technical men, and its adoption was slow in spite of its unique and valuable combination of properties. This condition has gradually changed and Monel metal in the last few years has been widely and increasingly used in the textile industry. Hosiery mill men, perhaps more than any other class of textile men, believed in the economies to be derived by using Monel metal, and to-day a large percentage of them are using machines and equipment made from this alloy.

Overdriven Extractor with Monel Metal Basket, Showing Safety Door Open.—American Laundry Machinery Co.

Because of the large variety of shades that have to be dyed in the up-to-date hosiery mill, a metal machine was soon found to be of great importance. When wooden equipment was used it absorbed a certain amount of color from the batch being dyed in the apparatus. When a new shade of a different color was to follow, a great deal of boiling out of the machine or apparatus was necessary. This resulted in much loss of time and necessitated the carrying of extra equipment. It was further found that closely related shades only could be dyed in the same wooden machine or tank, for even with a good boil-out only a portion of the color could be removed from the wood. When a new batch of a greatly different color was to be handled, the dyers



42 x 84" American Monel Metal Rotary Dyeing Machines.—Hanes Hosiery Mills Co., Winston-Salem, N. C.



Sectional View of Dyehouse, Showing Group of 42 x 84" American Monel Metal Rotary Machines. —United Hosiery Mills Corp., Chattanooga, Tenn.

found that the shade could not be made because the wood released some of the color from the previous batch. Soon the general practice was to dye only closely related shades in the same machine, and hosiery dyers were forced to either materially increase their plant or substitute equipment of a more suitable metal.

In this exigency Monel metal was given an opportunity and it has made good. It has wonderful resistance qualities for dyeing direct, acid and basic colors. It can also be used for peroxide bleaching equipment, and Monel metal machinery for bleaching with chlorine bleach is giving fine service.

The dyer can now change from one color to another by simply giving the Monel metal machine or tank a good washing out, by means of which every trace of color can be removed. This is a boon to small mills with limited equipment, for they can now use one machine for the entire output, dyeing black and shades in the one machine and bleaching in it when necessary.

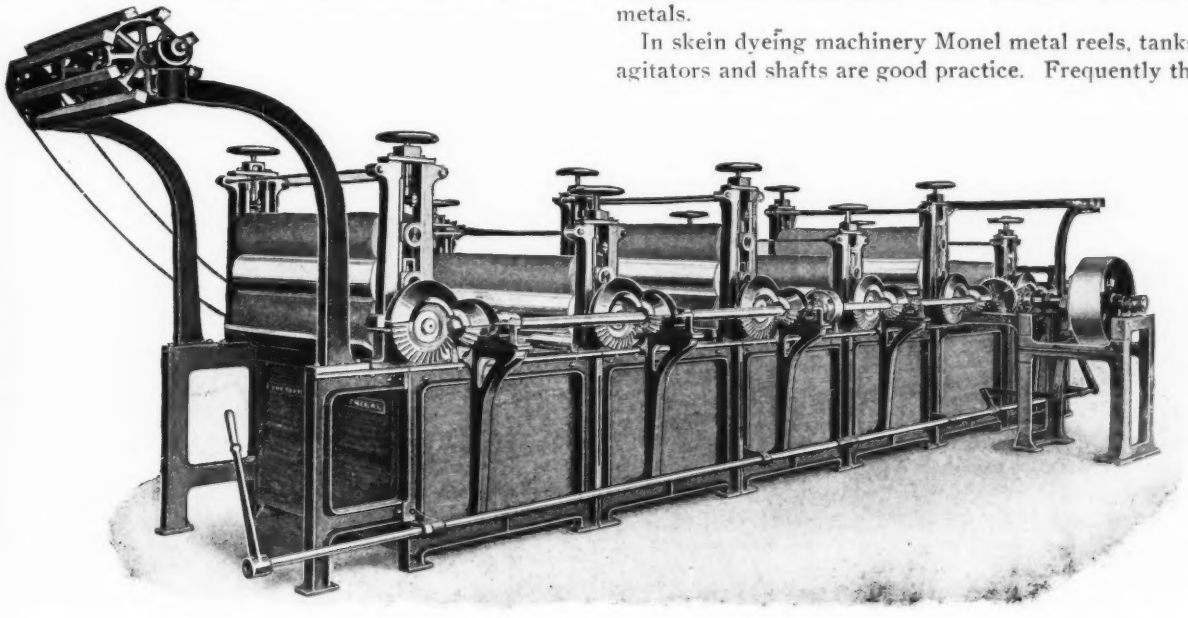
The illustrations at the left show sections of modern rotary Monel metal machines installed in two of the best hosiery mills in the United States. These mills dye every shade now in style and several special shades of their own. Should the demand for any one color become abnormally great, every machine in their dyehouse could instantly be made ready for this color. Monel metal equipment is very flexible in the uses to which it can be adapted, and machines and equipment are never idle due to having at one time been assigned to a certain color. While the dyehouse profits a great deal by the use of Monel metal, it must be kept in mind that it is stronger, tougher and more generally resistant to corrosion than any other metal on the market. For this reason it finds many other applications in textile mills of all types.

Lunkenheimer All Monel Metal "Renewo" Globe Valve

Perhaps the largest individual use of Monel metal in textile equipment is for tanks, tank linings, and the tie rods, bolts, nuts and washers, etc., used in the construction of wood tanks lined with Monel metal. The average equipment manufacturer or sheet-metal worker serving the textile industries is now as capable of handling Monel metal as he is of handling steel or copper. There seems to be no limit to the use of Monel metal and the economies it can effect in the textile mill.

The satisfaction obtained from using Monel metal dyeing machines led to its use for the baskets and other parts of extractors. These are now obtainable constructed from Monel metal, and possess particular advantages in the handling of silk after it has been weighted with tetrachloride of tin, to which this alloy appears to be considerably more resistant than other metals.

In skein dyeing machinery Monel metal reels, tanks, agitators and shafts are good practice. Frequently the



Six-Compartment Dyeing Machine with Monel Metal Rolls.—The Textile Finishing Machinery Co., Providence, R. I.

Hat Cones of Monel Metal.
—Sholes, Inc., New York City

shaft is inserted in a Monel metal tube to protect it from corrosion. The cylinders of beam dyeing machines give good service when lined with Monel metal, and any tendency to injure the yarn is avoided.

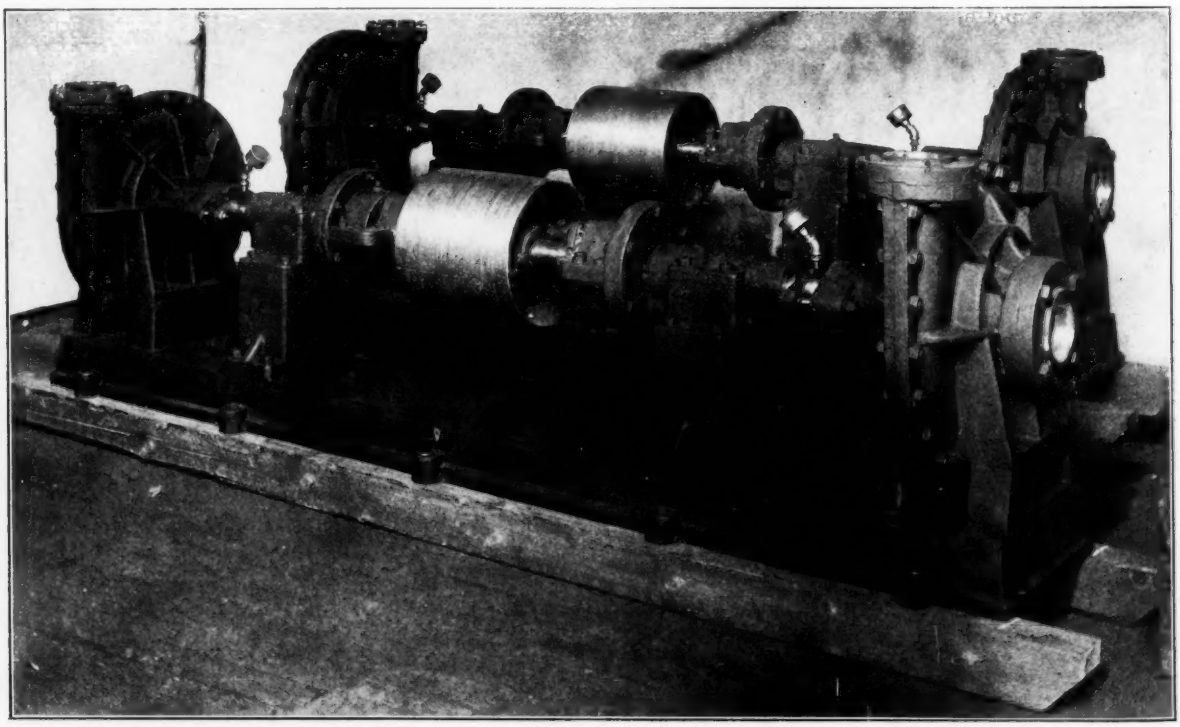
The handling of large quantities of corrosive liquids in the dyehouse has been made easier by the use of Monel metal pumps and pumps equipped with Monel metal shafts and impellers. These are now standard with a number of manufacturers and are giving excellent service under severe conditions. Although Monel metal tubing in iron pipe sizes cannot at present be secured, a very satisfactory drawn, welded tubing is on the market and serves the purpose very well if fitted with the standard S. A. E. thread (twenty-seven threads to the inch). A number of companies are manufacturing all-Monel metal valves and fittings. It seems as though the problem of economically handling corrosive liquids has been solved by the use of Monel metal equipment.

Specialists in textile mill ventilation are advocating the use of Monel metal fans. The service is often severe and frequently Monel metal is the only metal that will stand up under these conditions. Closely allied with the problem of ventilation is that of air conditioning, where Monel metal is finding favor in the construction of humidifying apparatus.

Among the more recent applications of Monel metal to textile finishing equipment are warper drop wires, guide wires and staples, jaws of tentering clips, especially for use with the "back-filled" process, where ordinary metals will not stand the constant grinding of the coarse filling. Manufacturers of carbonizing machinery find that Monel metal bolts last much longer than other metal bolts used in the construction of wooden carbonizing cages.

The adoption of Monel metal for the construction of the cylinders of steam-heated finishing machines is a distinct advance in practice. Formerly these cylinders required retinning as often as three times a year, with consequent loss of time and considerable expense to the mill owner. Recent developments in the welding of Monel metal make the construction of these drums possible, and the use of the metal for this purpose is increasing rapidly. Users of this type of finishing machine equipped with Monel metal cylinders note a marked improvement in the finish of the goods.

Reeds with Monel metal dents have been under trial

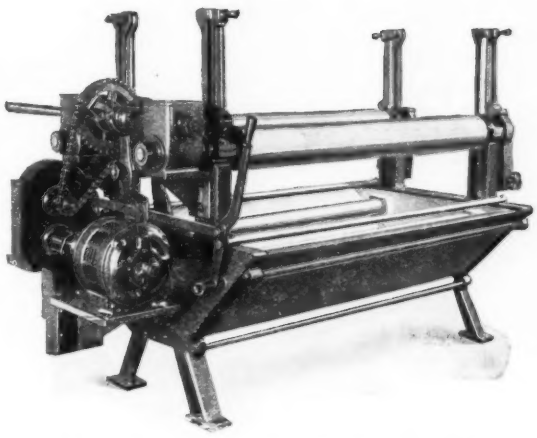


Centrifugal Pumps Equipped with Monel Metal Shafts and Impellers.—Lawrence Pump & Engine Co., Lawrence, Mass.

for some months and several mills have now adopted them. The Monel metal dents not only withstand the abrasion caused by the passage of the threads but do not rust or corrode. These Monel metal reeds have proved very successful on such diversified staples as corduroy and silk. Monel metal can be readily soldered, and for this reason it is being used on both the all-metal reed and the pitch-back reed.

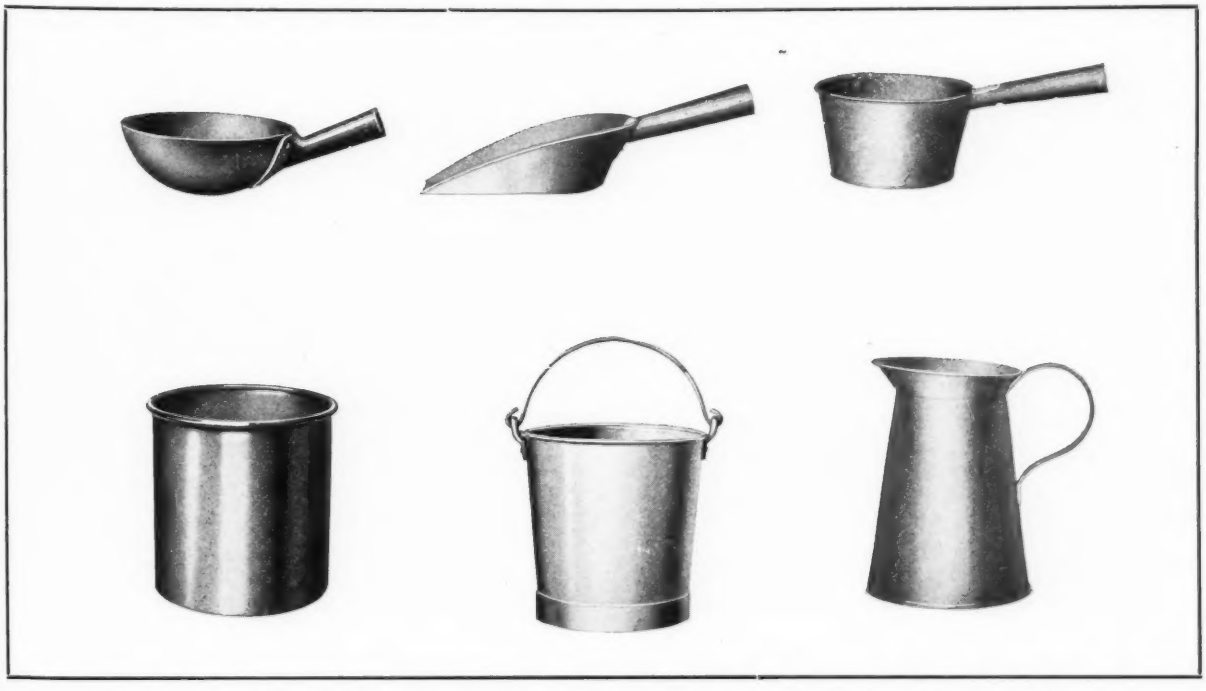
Pails and dippers of Monel metal, dye-paste color boxes, dye sticks, ladles, scoops and measures of this alloy are now on the market, and several manufacturers are advertising their ability to serve the trade with these and any special equipment required in Monel metal.

In the manufacture of felt hats Monel metal is being used to great advantage. This is a process in which the conditions vary from plain hot water to boiling sulphuric acid, through dyeing operations and an almost continuous steam atmosphere. Monel is being used for the cones on which the loose fur is formed and then dipped into or sprayed with either hot water or a solution of sulphuric and muriatic acids, the operations varying somewhat. These cones are made of finely perforated Monel metal cut in three pieces and silver-soldered together. Compared with the copper cones formerly in use, Monel metal cones give at least three times the life. Other applications to felt-hat manufacturing include the shafting of multi-rollers, fingers of stretching and blocking machines, shafting and sprockets on napping machinery, etc. Hat manufacturers should find much to interest them in these recent developments.



Special Monel Dye Jig Used in the Du Pont Laboratory, Wilmington, Del.—Made by Morrison Machine Co., Paterson, N. J.

The technical laboratories of E. I. du Pont de Nemours & Co., Inc., are equipped with a number of Monel metal dye jigs and hand vats. It is interesting to note that the dyeings which control the various batches of color are made in Monel metal equipment. Here the colors are standardized and matched, and Monel metal is proving entirely satisfactory. Its use under these conditions inspires confidence in its use for commercial dyeing purposes.



A Group of Monel Metal Utensils for the Dyehouse Made by Sholes, Inc., New York City

Defects in Woolen Piece Goods

Causes of Defects in Dyeing—Spots and Stains—Molds or Mildew—Chafes—Streaky Pieces—Shady Pieces —Cloudy Pieces—Poor Penetration—Specky Pieces—Tenderness

By RAYMOND R. STEVENS, B.T.C.

Assistant Dyer, The Felters Company

THIS article is an intended answer to some of the many questions asked as to the cause of the large number of "seconds" obtained in the manufacture of piece dyed wool or part wool goods, and, as far as possible, to give a comprehensible explanation of some of the causes and remedies for the same. During the late war, most mill organizations developed the tendency of shipping to their customers goods which, in previous times, would have immediately been rejected as unsatisfactory, but which under the then existing conditions were gladly accepted and put upon the market as rapidly as supplied.

As everyone in any way connected with the textile industry knows, the old order of things has and is changed. The man or mill who can with the least delay manufacture the best goods at a reasonable price, is the one who does the business. Any information which might enable him to improve his product without additional cost, or cause a decrease of goods injured in manufacture, would seem to be of the greatest possible value at this time. With this as an incentive, it is my intention to outline the causes and practical remedies, drawn chiefly from observation and experience, as related to the dyeing operation.

Causes

Most defects in dyeing come under one of the following heads: Spots, stains, molds, chafes, streaky or shady pieces, cloudy pieces, poor penetration, specky pieces, and breaky or tender pieces. Not all of these are wholly attributable to the dyeing process, but many of them can be caused or are first noticed in that department. While all of the above defects may be somewhat related as to causes and possibly remedies, each one presents an entirely different problem and all are to be avoided.

Spots and Stains

Spots as a rule are localized defects and, while varying in size, are usually associated with small, distinct discolorations of an external and mechanical nature. They may be found at regular intervals throughout the goods, or at random in only portions of the same. Spots invariably spell neglect or carelessness. Dripping water, dripping oil, dropping rustflakes, loose grease, carbonizing spots, and undissolved dyestuffs, are some of the causes for spots, many of which suggest their own remedies.

Grease and oil spots, if not too large, can often be partially removed by the use of such solvents as naphtha or carbon tetrachloride. If oil spots are fresh, another method, rubbing in of a soluble oil such as lard oil and rescouring, is sometimes successful. Rust spots can sometimes be removed by the use of a solution of oxalic acid. Dye spots cannot usually be removed and are corrected only by redyeing into a deeper shade.

It would seem from experience far easier to prevent spotting of goods than to try to correct them. The following precautions, if taken in any dyehouse, will tend greatly to cut down the number of spots noticed at the finish perch:

1. Frequent inspection and painting of all overhead water and steam piping, wiring fixtures, fans and sprinkler systems.
2. Proper ventilation to prevent excessive condensation on overhead pipes and dripping from the roof.
3. Use of extreme care to prevent spotting with water after carbonizing previous to neutralizing.
4. Oil pans placed under all bearings of drive, ventilating fans, motors, etc.
5. Complete solution of dyestuffs and straining of the same through a fine sieve or muslin cloth.

Stains are those defects due usually to actual contact with chemicals, substances, or materials foreign to the proper manufacturing procedure. Stains and their causes can be separated into two classes: (a) mechanical stains, (b) chemical stains. Not only must the stain be removed if possible, but its cause determined so that it occurrence may be prevented in the future.

Mechanical stains are illustrated by box or wagon marks, reel stains, and stains from lying on floor or new wood. If the goods coming to the dyehouse have been allowed to lie on the floor in the fulling process, in the soap, for any great length of time—say, over a day or two, or long enough to heat up at all—the portions so affected or in contact with the floor show up in the finished piece as sharp, distinct stains. In the dyeing process, if in removing light shade pieces from a kettle they are thrown over a stained take-off reel, the ends of the pieces show reel marks running fillingwise for several yards from the ends of the pieces. This is very likely to happen in changing the shade dyed in a kettle from a dark shade to one very much lighter. If some types of goods are allowed to stand overnight thrown over the winch of a kettle they are likely to become discolored or stained from the wood.

Chemical stains are illustrated by alkali or acid

stains, copper or iron stains, extractor stains, bleach or stoving stains. Box or wagon marks are caused by the use of stained boxes from previous dyeings of wagons used to handle stoved or sulphured pieces, of wagons from carbonizing department not properly neutralized, of wagons stained or saturated with alkali, or of wagons papered or lined with colored paper. Previous to the centriffing of light shades, extractors must be rinsed out and colored strings removed, or stains are apt to result. Colored goods should not be allowed to remain or lie in an extractor many hours, as some shades are affected by contact with the metal. Such stains can often be detected or identified by the polka-dot effect produced by the perforations in the extractor basket.

Molds or Mildew

Mildew is that defect caused by the action of a low vegetable life known as fungi. This destruction is caused or aided by moist heat. In summer weather, goods in the soap and sometimes clean are apt to mold if allowed to stand any length of time in a damp or wet condition. Mildew first appears in the form of spots, but if far enough advanced it may cause actual holes in the fabric.

Mildew cannot be remedied but can be prevented. Prevention consists of not allowing goods to lie around wet, and when storing goods, either finished or in the gray, by storing in a dry place. However, if it becomes necessary to let wet goods stand any length of time, wetting out or rinsing with warm water in the washer occasionally will tend to prevent mildew, especially if a small amount of formaldehyde is added to the rinse water.

It must always be kept in mind that mildew usually means a total loss. Redyeing moldy pieces is of no avail, as the defect is never covered up and the fabric is still further weakened by the extended treatment.

Chafes

A chafe is a defect caused by continued rubbing or friction upon a certain portion of the goods. While not of as great prevalence in dyeing as in fulling and other operations, it may be caused there by dragging in the piece dye kettle due to overloading, lack of liquor, or stopping of the front roll. Knots and tie-ups in the kettle, if not immediately noticed, cause chafing, for the winch continues to turn while the pieces cannot revolve, held as they are by the front gate. A defective back in a kettle or sharp protruding boards tend to ruff up the fabric and may produce chafe marks in the finished material. Chafes are very apt to be noticed in goods of light shade, in which they are not covered very well.

Streaky Pieces

Streakiness is the cause for the largest number of "seconds" or poorly colored pieces in every mill. Some of the most common causes for streaky pieces in acid piece dye work are the following:

1. Goods not being thoroughly wet out.
2. Goods not being clean.
3. Starting at too high a temperature.
4. Bringing to the boil too quickly.
5. Too rapid addition of color.
6. Use of wrong color.
7. Adding improper acid.
8. Adding acid too rapidly.
9. Not enough Glauber salt.
10. Too short a bath.
11. Too much material in kettle.
12. Stopping of winch during dyeing.
13. Feeding on non-leveling colors.
14. Too short a boil.

Shady Pieces

Shady pieces differ from streaky pieces in that they possess a more gradual variation in shade which is not as sharp or distinct as that found in streaky goods.

It may be, and often is, caused in operations other than the coloring. If caused in dyeing it is apt to be due to: (1) Poor distribution of heat in the kettle—that is, all parts of the liquor are not at the same temperature, which causes the color to develop unevenly; (2) tight selvedges, which cause the pieces to list or roll, and also to shade heavier to the center; (3) direct steam blowing directly on goods in kettle, developing color unevenly.

Shadiness may be caused outside of the dyeing process by: (1) Uneven crabbing, (2) uneven shearing, (3) uneven pressing, and (4) uneven blow-steaming. As the dyer has no direct control over the above factors, it is not my purpose to go into detail, but simply to mention their frequent occurrence.

Oftentimes a temporary shadiness is found in goods just off the press, due to uneven cooling; but as a rule the original shade is regained when cooled.

Cloudy Pieces

Cloudiness is that effect in a finished piece which gives it a blotchy, spotty or clouded appearance. It is usually due to the presence of an insoluble or unremoved soap left in the goods, the use of an improper soap in fulling or scouring, or to the use of a stock containing aluminum chloride not entirely removed after carbonizing.

Cloudy pieces, if they contain soap, usually possess a rancid odor which is very objectionable. This odor may also be due to the incomplete removal of all unsaponifiable wool oil in the scouring process.

If goods are coming cloudy the following precautions may clear up the trouble: (1) Extend the rinsing period in the washer; (2) Check up contents of soap, cutting down per cent of tallow soap if any is present; (3) Investigate properties of wool oil; (4) Boil up pieces in kettle previous to dyeing with 1 per cent of ammonia.

If necessary to redye soapy or cloudy pieces, a short boil-off with ammonia previous to redyeing tends to remove soap and clear up the goods.

Poor Penetration

Poor penetration, found usually in goods of heavier weights, is due to too short a dyeing process, not using Glauber salt enough in the same, uneven dyeing, and dyeing after incomplete removal of soap from heavy goods. A fabric of hard-spun and hard-felted character is quite susceptible to this defect.

Poor penetration of goods is undesirable, in that a close shearing cuts down into the fabric and shows up light spots or the uncolored portion of the fabric. Poor penetration can be overcome by extending the length of time before bringing to the boil, extending the length of time at the boil, and increasing the amount of Glauber salt added to the bath.

In cases of very heavy goods I have known it to be necessary to run the material lukewarm for an hour previous to adding any acid. When this is done, however, care must be taken to feed the acid on in small amounts at intervals, or the color will be all deposited on the outside of the goods.

Specky Pieces

Specky pieces is that designation given goods when foreign material, either in the fibers to start with or accumulated in the process, shows up in the finished piece to such an extent that it becomes objectionable. One of the greatest bugbears of any acid-dyeing process on woolens is the presence in finished pieces of small amounts of cotton or vegetable material. Shives, burs, cotton thread, cotton lint and vegetable fibers are the principal offenders in specky woolen goods. These may be present in the original raw material used to make the fabric, or they may be introduced in the manufacturing process.

The chief remedies for specky pieces are carbonizing or speck dyeing. In many cases carbonizing after coloring is impractical, in that the colors used in dyeing the fabric in question were not selected to withstand the extra treatment. Speck-dyeing, or the introduction of color having an affinity for the vegetable material in a cold bath, is usually more practical if the goods are not known to be fast to carbonizing.

Tenderness

Tenderness is that lack of tensile strength in a fabric which makes it unsalable, unusable, or lessens its value. There are many degrees of tenderness and several types, such as breaky pieces and redyed pieces. Breaky pieces contain that lack of tensile strength due, as a rule, not to subjection to chemical influences but to poor layout or design or actual weakness in the fibers used to make the fabric. Many times a breaky piece shows that property when inspected by looking through the goods. The light shows through in spots and the piece looks thin or mottled.

Tenderness is often found in goods which have been redyed, the causes for which lie in the extra handling necessary to that operation. An extra boiling and possibly a previous stripping are indispensable to redyeing.

Stripping may consist of boiling in (1) soap solution (cotton worsteds), (2) Glauber salt, (3) technical stripping agents, (4) bichromate of soda and sulphuric acid, or (5) ammonia. Each and all are injurious to the fiber, the degree depending upon the one used and the length of the treatment, which, in turn, depends upon the kind of color to be stripped and the amount necessary to be removed.

Tendering from the action of alkali in scouring, neutralizing after carbonizing, etc., may also occur. Care in the use of soda, monohydrate of soda, caustic soda and ammonia is necessary, especially if used at high temperatures.

Boiling for a great length of time in a bath of a greater strength than 4 pounds of vitriol to 100 pounds of goods weakens and may finally tender woolens.

Another loss coincident with tendering is the inability to finish properly. Stripping and tearing from the pins on the drier, and the consequent remnants, are distinct losses. When woolens tender it is a good policy to look through the process for contact with an alkali at a raised temperature. A tender piece of goods contains a defect which cannot be remedied. The loss is final, irreparable and, therefore, exceedingly undesirable.

DODGE SALES & ENGINEERING COMPANY CONSOLIDATES WITH DODGE MFG. CO.

The Dodge Sales & Engineering Company, Mishawaka, Ind., which has for the past eight years been operating as the selling subsidiary of the Dodge Manufacturing Company and Dodge Steel Pulley Corporation, has now been consolidated with the parent company, Dodge Manufacturing Corporation, which was organized and began business last July.

The distribution of Dodge products, which has heretofore been done under the name of the Dodge Sales & Engineering Company, will hereafter be conducted by the sales department of the Dodge Manufacturing Corporation, with Duncan J. Campbell, general sales manager, in charge and John A. Benyon assistant general sales manager. The district sales organization of the Dodge Sales & Engineering Company will be continued as branches of the sales department.

Handy Graphics—V

Money Values of Dyes

Objects of Money Value Tests—Simple Chart for the Purpose—Applicable to Any Dyestuff—Accuracy Equal to Present Methods

CHARLES F. GOLDTHWAIT
Baltimore Processing Company, Baltimore, Md.

and

JOHN E. HOFF
Klearflax Linen Looms, Inc., Duluth, Minn.

Part Five of a Series on Textile Chemical Uses of Ratio Paper and Logarithmic Scales

OF all the problems confronting the color chemist, the determination of money values is one of the most important, as it is so closely connected with cost of production.

At times of declining dye prices, attention to their comparative values is especially fruitful, for many colors can be obtained from different sources identical in their essential properties but of different strengths or prices; and each cut in cost is a step toward profits.

The term "money value" as used in connection with dyes may appear to have more than one meaning, but since there is no absolute measure of such a quantity in terms of a definite unit we always arrive at a result by comparison with other colors, and therefore we are really discussing only comparative or relative value.

For all practical purposes we want to know first whether a new offering is better value than a color already in use, it being assumed that it has been found satisfactory in other respects. This is a problem in comparative values. If found satisfactory, the next question is to determine its strength so that any necessary adjustments can be made in the formulas. This is a problem in comparative strengths. Time is saved in dye testing by keeping these two ideas separate, as the second type of test can often be eliminated by the first.

In considering a new color of known properties we usually want a quick decision as to whether it is a good purchase, and at the moment it rarely matters whether it is 5, 10 or 20 per cent better. After the order is placed there is plenty of time to take care of formula details before delivery is made.

Introducing the Chart

The chart in *Fig.* 1 is based on the familiar scheme of making dyeings with amounts of color inversely proportional to the prices. Then the dyeings represent equal costs, and the one that comes out darkest is the best value. This is frequently worked out as an individual problem for each comparison, or a large number of these values can be calculated and put into a table and much future time saved. It will be found, however, that where you have much routine work you will be forever calculating new intermediate values. In the chart these calculations

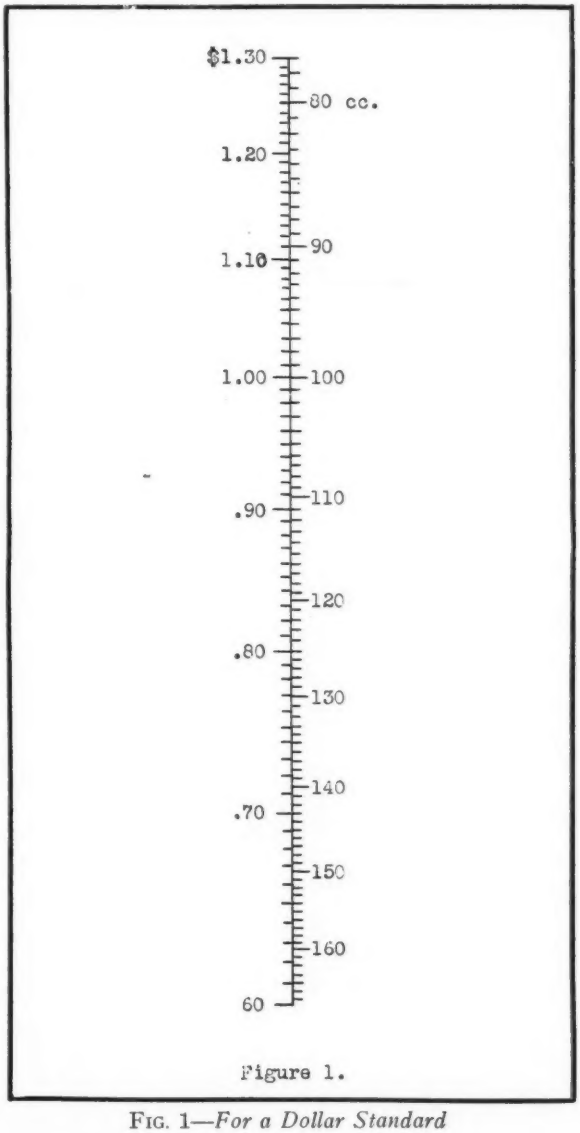


FIG. 1—*For a Dollar Standard*

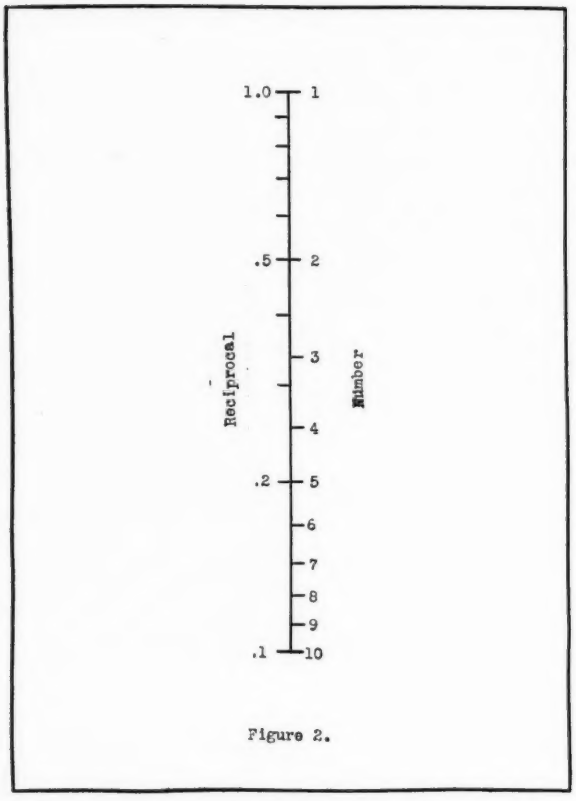


Figure 2.

FIG. 2—*Reciprocal Scale*

are all ready-made and it is only necessary to read the results.

Take, for instance, this range of Benzorpurpurines offered in 100-pound lots in competition:

TABLE 1

Dye	Price	C.C. for Test
A	$1.30	76.9
B	1.02	98.0
C	0.97	103.0
D	0.92	108.6
E	0.82	121.9
F	0.77	129.8

A ready-made table to cover this range and allow for future price changes should have every value from 75 cents to $1.30 by 1-cent intervals.

On the chart, however, you simply look opposite the price and read the number of cubic centimeters required for the test. In this case, the colors are all compared with an imaginary standard at $1, dyed at 1 per cent with 100 c.c. of 1 gram per liter solution. Whether we actually have this dollar color or not, the dyeings are strictly comparable with each other and can be roughly compared with any other dyeings made in the past or future to the standard.

Having satisfied yourself that it works by checking the figures given, it will be interesting to see why. It is only another very simple application of elementary mathematics. *Fig.* 1 is a reciprocal as well as a money-value chart. Opposite any number on the left you can read on the right the sequence of figures corresponding to its reciprocal. Now notice *Fig.* 2, which is just the same thing except that it is laid down as one complete cycle of a logarithm scale reading up and another reading down.

The whole distance on the left side represents the logarithm of 1. Since 1 is to be divided by the numbers from 1 to 10 (shown at the right) and we subtract logarithms to effect division, it can be seen that reading the number opposite 2, for example, simple subtracts the logarithm of 2 from that of 1 and leaves the logarithm of the answer. Our method of graduating, however, gives the result direct, 0.5. With this hint, the explanation of the other charts can be worked out.

A UNIVERSAL METHOD

The scheme outlined can be applied to any dye, at any price and at any strength of dye test by suitably designing the charts, but a single good chart can also be used directly for a variety of tests. Consider Chrysophenine offered at "single" strength and "concentrated," which is between two and three times as strong. A group of present quotation is:

TABLE 2

Color	Price	C.C. Dye to Use
A conc.	$2.35	42.5
B conc.	2.50	40.0
C single	0.90	111.1
D single	0.80	125.0
E single	1.00	100.0

Only three of these seem to come within chart 1; but divide the first two mentally by 2, look up the number of cubic centimeters corresponding to this half price and divide that by 2. The result will be exactly the same as that obtained by long-hand calculation. The prices indicate that there is probably a variety of strengths in this set. The test will show which is the best, so it is only necessary to accurately determine the strength of one single color if one is to be adopted in place of the dye already in use.

Now, even though quite a variety of dyes may range around a dollar in price, some of them are likely to be used in 2 per cent and others in ½ per cent shades, so it may be better to dye them at approximately these figures instead of our standard of 1 per cent. The simplest scheme so that you can use the same chart is to dissolve 2 grams or ½ gram of dye to a liter and use the figures directly. If, however, it is preferable to keep all dye solutions of the same standard strength, the chart readings can be multiplied or divided by 2, or any other factor.

In still another case a 5-gram or a 20-gram skein may

be preferred to ten. Simply multiply by ½ or 2 to get the proper amounts of dye.

Different Standard Dye Tests

It is the logical thing, of course, where there is much routine, to have charts fit the standard dye tests in use, and a separate one can be easily made for each. The rule is to place the standard price on one logarithm scale against the standard number of cubic centimeters (or standard per cent dye) on a similar but inverted scale. Chop the scales off the desired price limits and the chart is made.

These points are proved by *Fig.* 3, A and B. The first scale covers tests based on a price of 75 cents and a standard dye test of 100 c.c. of solution; the second is for tests to a price of 40 cents and to 50 c.c. of solution. Two-dollar colors will work out as readily, and if you are so unfortunate as to require five-dollar colors you can make a chart for them.

While the writers have not had occasion to try a great variety of these graphs, there seems to be no limitation to their use.

Accurate as You Please

Questions of accuracy always recall the familiar remark about the strength of the chain. Dye testing is no more accurate than the "weakest" of the factors that affect it. For the ordinary consumer, who is the party most interested in money values, the most fallible part of the test is the final judgment of the result. The accuracy of comparing shades is generally conceded to be somewhere between 2 and 5 per cent. Neglecting various unmeasurable sources of error, which may be great or small in proportion to the care used in the tests, we next come to weighings and measurements of solution. The weights can be made as accurate as desired, aside from a possible uncertainty as to the samples of yarn or cloth being exactly identical. Measurements of solutions are exact to a fraction of a per cent; within a tenth per cent, if you wish to use a burette. Of all the factors in the test, the reading of a chart comes nearest to the reading of a burette.

So, while one might say offhand that a chart would not be accurate, there is no reason why a scale on paper cannot be graduated as accurately as one on a graduated pipette or burette, and then if any doubt still remains the chart readings can be made as large as the graduations on the measuring device, and the question of chart accuracy is disposed of for good.

In practice a chart can be read a great deal closer than a liquid surface with a meniscus, so this extreme suggestion is not at all necessary. Remember, too, that although the graduations vary in fineness, the *percentage accuracy* is the same in all parts of the scales.

The writers have constructed a 20-inch cycle log scale from which *Fig.* 1 was made, and it is found fine enough.

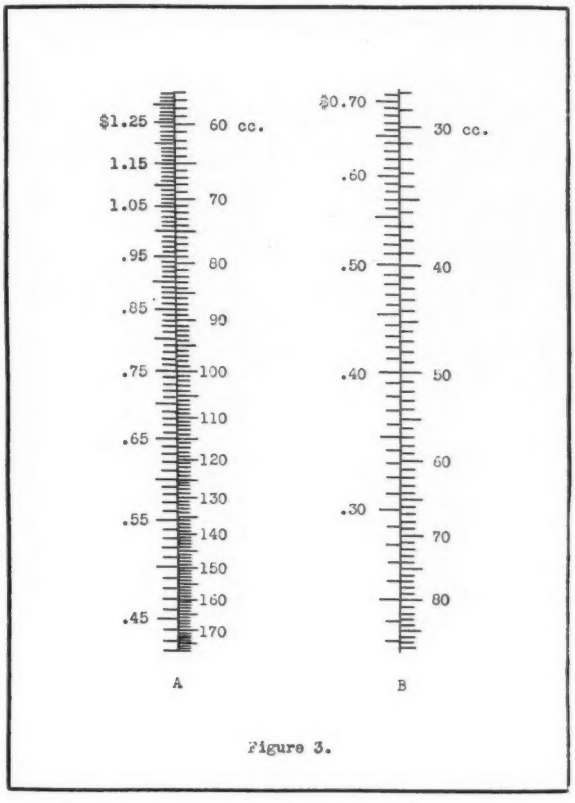


Figure 3.

Fig. 3—*For Different Standards*

Even the 10-inch, which can be readily copied from a slide rule or from commercial log paper, will answer most purposes. If the requirements are really high, a suitable small section of the scales can be made in any desired size.

In a sense, this is another "slide rule application" of charting, because exactly the same combination of scales can be effected with the rule. With the chart, however, the setting can be made permanent and filed for repeated use.

Simple methods for constructing and subdividing log scales will be found in the last article of this series.

(Part VI will follow in the next issue.)

U. S. SILK MISSION OFF FOR ORIENT

The second American Silk Mission from the Silk Association of America sailed for the Orient on Thursday, February 25, from San Francisco, on the President Cleveland. The group will make day stops in Yokohama and Hongkong, and begin its survey of the silk industry at Canton. All the important silk centers of the Orient will be visited, and the raw silk industry carefully studied.

The group in the mission includes representatives of most of the important branches of the industry in

America. James A. Goldsmith, who is accompanied by Mrs. Goldsmith, acts as chairman. Mr. Goldsmith is president of the Silk Association of America.

The other members of the Silk Mission are Eugene Atwood of the Atwood Machine Company, and Mrs. Atwood; E. E. Bradley, also of the Atwood Machine Company, and Mrs. Bradley; Austin Cheney, of Cheney Brothers, and Mrs. Cheney; D. E. Douty, vice-president and general manager of the United States Testing Company, Inc., and Mrs. Douty; Carl Schoen, president of the Carl Schoen Silk Corporation, and Mrs. Schoen; Edwin F. Bayer, Jr., of Julius Kayser & Co.,; Ward Cheney, of Cheney Brothers; Myron S. Falk, of Wonham, Bates & Goode Trading Corporation, and Roy J. Schwartz, of the United States Testing Company, Inc.

Scientific Washing

I—Soap

Characteristics and Properties of Soap—The Fatty Acids—Surface Tension—High and Low Surface Tension and Their Effects—Emulsification and "Wetting"—Surface Viscosity—Formation of Suds —Suds as an Indicator—Colloidal Adsorption—How Colloids Clean—Why Soap Solutions Become Exhausted—Recovering Soap from Suds Water—Dry and Liquid Application

By F. H. GUERNSEY

Chief Chemist, the Cowles Detergent Company, Lockport, N. Y.

Soap—Its Characteristics and Properties

SOAP is an alkali—a chemical compound in which the alkali is combined with an acid—a fatty acid. When the two are in balanced relations chemically, the fat soap is said to be neutral, though it still shows a test for alkali when dissolved in water.

In the manufacture of soap the fatty acids are not only

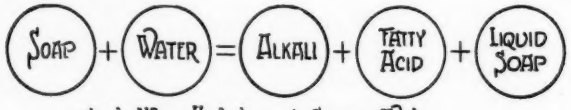


Chart N°1a. Hydrolysis of Soap in Water.

used pure but also in the form of neutral fats called glycerides. Meat fats, kitchen grease or tallow are the glycerides of fatty acids, chiefly stearic. They represent a combination of the acid with a small amount of glycerine, about 10 per cent. When subjected to the action of an alkali under the proper conditions, the acid portion of the fat breaks away from the glycerine and combines with the alkali to form soap. This process is termed saponification.

Sometimes the stock is used without troubling to remove the glycerine. When necessary to remove it the soap is run into pans, salt is added, and as the soap is not soluble in a salt solution it rises to the surface, whence it is removed. The remaining liquor contains the glycerine.

The manufacture of soap in the laundry is not to be recommended as good practice, for it usually results in a product containing free alkali. This gives rise to the mistaken idea that a home-made soap is more efficient than a purchased one. Any unusual strength apparent in such soaps is traceable to the free alkali, or caustic, a source of injury to the life and colors of clothing.

The Fatty Acids

The acids which are of the most importance and value in soap manufacture are oleic, stearic and palmitic.

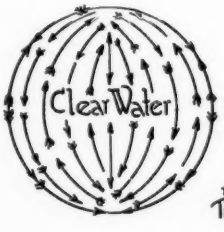
Oleic acid is liquid at ordinary temperatures and looks very much like ordinary motor oil. Stearic and palmitic acids are solids and of about the consistency of paraffine wax.

Soaps prepared from stock in which oleic acid predominates will be more or less soft, while those prepared from the solid fatty acids will be harder and firmer.

What Happens When Soap Dissolves

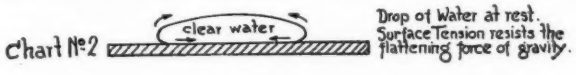
There is no doubt that the detergent action of soap depends upon a combination of chemical and physical causes.

When soap dissolves in water, the soap decomposes or separates to a certain extent, with the liberation of alkali and a fatty acid derivative. This fatty acid derivative has the characteristics of a grease. The process of decomposition is technically spoken of as hydrolysis. The extent of hydrolysis is increased at higher temperatures, and in dilute solutions of soap, such as in the first hot rinse behind the suds.



Drop of water, suspended in Air. Lines represent Surface Tension Forces pulling equally in all directions They hold the drop in spherical shape

The soaps prepared from soft stock decompose more easily than those prepared from a hard stock. At the temperatures of the wash wheel the extent of decomposition of soft soaps is such as to practically render them unsuitable for use under these conditions; at least,



they are inferior to the harder soaps. At lower temperatures, the reverse is true. A soap prepared from a tallow base seems best adapted to the wash-wheel conditions.

1. *Alkali.*—The alkali released from a neutral soap plays a very insignificant part in the cleansing process.

2. *Fatty Acid.*—The fatty acid portion of the soap is released in the nature of a "colloid"; that is, in finely divided particles, so fine as to be invisible to the naked eye and too fine to be filtered out by the best filter paper. No definite value in cleansing can be attributed to this product of hydrolysis.

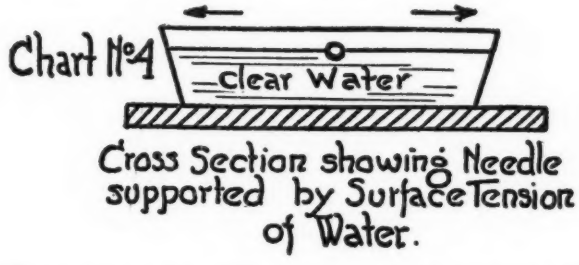
3. *Unhydrolyzed Soap.*—The greater portion of dissolved soap remains undecomposed, but distributed throughout the mass of the solution. This undecomposed soap is more highly colloidal, and the truly efficient form or condition for cleansing purposes.

Surface Tension

Several other changes take place when soap goes into solution. The first of these is a marked change in surface tension.

Gases tend to expand and increase their volume. On the other hand, the surface of a liquid tends to contract and occupy a smaller volume. The tension thus produced at the surface of liquids is known as surface tension.

Putting it in other words, surface tension is that force which resists any attempt to increase the area of the surface. Water has the highest surface tension (70) except mercury (450). Technically speaking, the surface tension of water is about 72 dynes per linear centimeter, diminishing with increase in temperature. If, after dissolving soap in the same water, we again measure the surface tension with suitable apparatus we find that it has been lowered to about 28 or 30 dynes.

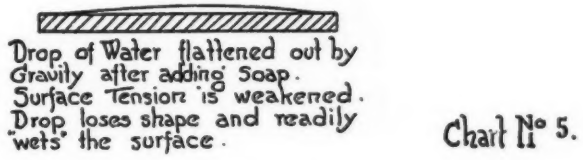


A drop of any liquid becomes round when in the air, and its surface, like that of a toy balloon, is under strain. Each portion pulls with equal strength against its neighbor. At any point on the surface this strain is apparent, equal in all directions. The natural result is to assume the shape of a sphere when in the air without support. *If imaginary rubber bands were stretched around the drop in every direction, their pulling power would represent the surface tension.*

Were the surface tension forces strong enough, the drop would become rigid. Mercury comes nearest to this condition. Its drops remain nearly round even when resting on a hard surface.

Results of High Surface Tension

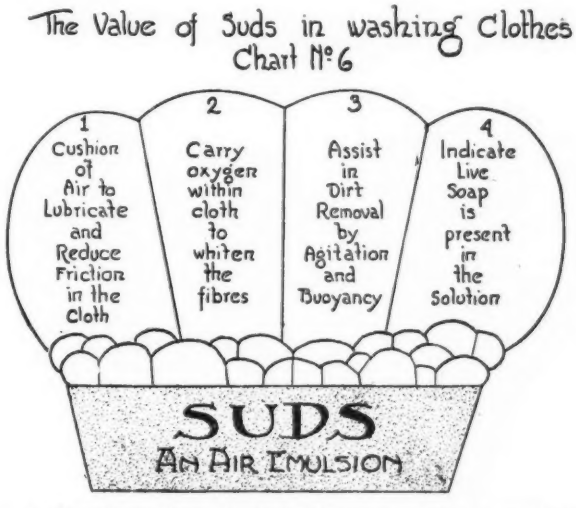
High surface tension thus causes the liquid to resist flattening out by its own weight, and it also resists the entry of any other substance into the body of the liquid.


Drop of Water flattened out by Gravity after adding Soap.
Surface Tension is weakened.
Drop loses shape and readily "wets" the surface.
Chart No 5.

Hence a drop of clear water on a flat surface looks as in chart No. 2.

Low Surface Tension and Its Effect

When soap is added to water, the surface tension is lessened. A drop then flattens out readily (see chart No. 5) and its surface can be penetrated more easily than that of clear water.


The Value of Suds in washing Clothes
Chart No 6
1
Cushion of Air to Lubricate and Reduce Friction in the Cloth
2
Carry oxygen within cloth to whiten the fibres
3
Assist in Dirt Removal by Agitation and Buoyancy
4
Indicate Live Soap is present in the Solution
SUDS
An Air Emulsion

A thread or piece of cloth will now readily absorb the drop, or, in other words, become "wet." On shaking, air will now enter the surface of the liquid, the mixture forming an "emulsion of air," or suds. This suds, however, does not "stand up" or last unless there be also right conditions of surface viscosity or body. (See paragraph on surface viscosity appearing later.)

Surface tension conditions exist between air and liquid; between liquid and the sides of its container; between liquid and anything immersed in the liquid, such as the goods being washed; between liquid and dirt, etc.

It will be seen from this that the condition is not only evident at the surface exposed to the air, but also to any other surface where the liquid may touch an object, such as the sides of the wheel, pieces of dirt, drops of oil, etc. When the surface under consideration is immersed in the solution, as in the case of a piece of dirt suspended in the liquid, this state of tension is called "interfacial" tension.

Lowered surface tension is brought about by the formation of a liquid film on these various surfaces, and the film itself is due to the concentration of undecomposed (unhydrolyzed) soap in the surface of the liquid. In other words, this surface film is more concentrated (contains more soap) than the mass of the solution.

How Low Surface Tension Improves Washing Action

Our next thought concerns the relation of this low tension and surface film to the washing process.

We know that liquid drops and solid grains (both classed as dirt) will coalesce or unite, if allowed to come into actual contact. In the washing process drops of oil or grease (melted) and grains of dirt are broken up by agitation. While suspended in the solution, whose surface tension is low, its surface film immediately surrounds or envelops the fragments, keeping them separated, preventing coalescence or blending, and establishing conditions favorable to the removal of this foreign matter.

Emulsification and "Wetting"

This action is commonly termed "emulsification," although strictly speaking in the case of solid dirt the term "adsorption," to which we refer later, is more correct. Incidental, and important in connection with this emulsification, is the power of a soap solution to "wet" a surface. This is a combined function of the low surface tension and the property of adsorption. A simple demonstration of "wetting" is conducted as follows:

Upon a porcelain plate coated with vaseline (unsaponifiable mineral grease) place a few drops of water. The high surface tension of the water will cause it to remain as round drops indefinitely. To one or two of the drops add a small quantity of soap solution. As the soap spreads throughout the drop of water, one observes that the entire drop is gradually flattening out and conforming to the surface of the grease-covered plate. Now compare with the drops of plain water.

Surface Viscosity

Our next observation, on making a solution of soap and water, is a change in the *viscosity of the surface* of the solution.

As stated above, the undecomposed molecules of soap collect or concentrate in the surface of the solution, the solution being richer at the surface (any surface—air, dirt, oil, etc.) than the mass of liquid. This condition causes the low surface tension. But it also causes an increase in the surface viscosity or surface rigidity of the solution. It gives to the surface the nature of a skin. To make this plain, assume that a certain pond of water is our soap solution. Normally the surface is limpid, but adding soap to it produces a more rigid surface likened unto the formation of ice, although, of course, much less pronounced. "Syrupy" is a good description of the viscous condition.

How Suds Are Formed

A suds, perhaps the one distinguishing feature which everyone notices about a soap solution, *is an emulsion of air in the solution.*

Because the surface tension of a soap solution between the air and the solution is low, air is quite easily emulsified. The air readily penetrates the solution when the latter is agitated and is broken up into small divisions, each being surrounded by a film composed of the liquid. High surface viscosity results in strength and permanence of these bubbles. This condition is exactly analogous to the oil-soap mixture (emulsion) which is prompted by the low "interfacial tension" between the oil and the solution of soap beneath the surface—i. e., within the body of the solution. The suds formed by virtue of the low surface tension would lack permanence or stability unless the surface of the solution is stabilized, strengthened or "rubberized" in some way. An increased surface viscosity fulfills this requirement and provides, as one might say, a surface for the suds to ride upon.

Suds Serve as Indicator

The value of the suds to the washing process consists in:

1. The creation of a cushion of air to lighten some of the wear and tear of the machine.
2. Providing a means of incorporating air which exerts a whitening effect upon the goods, due to the presence of oxygen.
3. Assisting in dirt removal by air agitation in the fibers and buoyancy.
4. Functioning as an *indicator of the presence of active soap (suitable for cleansing)* by which the washman is guided in determining or watching the extent of exhaustion of his soap solution during the suds operation.

Colloidal Adsorption—Its Importance in Cleaning

In discussing the suspension of dirt, the term "adsorption" was mentioned. There is a difference between "aD-sorption" and "aB-sorption."

"Absorption" describes the process of *taking in* or consuming an object in such manner that the object *becomes a part of the material* which consumed it, the object losing its identity.

"Adsorption" refers to the process of *taking on*, as a process of adhesion. To illustrate, we might think of dissolving sugar in water, a process of *ab*-sorption; and the attaching of a postage stamp to an envelope as a process of *ad*-sorption.

All colloidal solutions contain ultramicroscopic particles so well dispersed or scattered that they cannot be filtered out. The particles constitute the "dispersed phase," while the medium in which they are scattered is called the "dispersing phase." A fog is an example of the colloidal state, raindrops constituting the dispersed phase and the air the dispersing phase. In the case of smoke, particles of carbon or soot constitute the dispersed phase.

The colloidal properties of certain clays are responsible for the transportation of clay particles in suspension by the Mississippi River, giving the water a distinctly reddish color.

Waters in some other localities exhibit similar phenomena. At the mouth of the Mississippi salt water causes the colloidal bodies to coagulate and settle, forming a deposit of salt. Similarly, in washing, the presence of a sulphate or chloride interferes with colloidal action. Salt is a good precipitating agent for those launderers who have no water other than one carrying colloidal clay in suspension.

Soap is a water-soluble colloid and is distributed, as well as the fatty acid product which is set free by hydrolysis (mentioned above), throughout the water as a finely divided "dispersed phase." All colloidal substances have the property of being adsorbed, and this adsorption may take place between solids and solutions, solids and pure liquids, solids and gases, solutions or liquids and gases, solids and solids, etc.

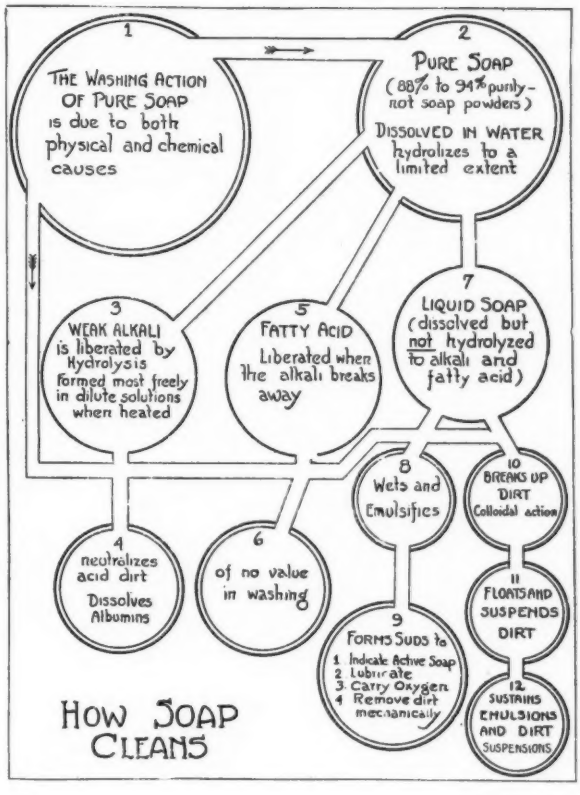
The adsorption of poison gases by specially prepared charcoal in gas masks is one example of adsorption between solids and gases.

How Colloids Clean

Adsorption is a very important property of soap. It *extensively adsorbs many liquids and solids.* Remember that adsorption is a colloidal property. In the case of solids particularly, this feature is of indispensable value to cleansing operations. The soap may be said to agglomerate or "pile up" on the dirt surface and pry it away from the surface (cloth) to which it is adhering.

If one examines these colloidal particles of soap under the ultramicroscope he observes that they are in constant agitation or oscillation, continuously in motion without regard for direction. The finer the particles the more rapid is the vibration. This movement of colloidal particles is called the Brownian movement, and is regarded as the visible symbol of "molecular bombardment"—i. e., the molecules throwing themselves against a particle of dirt, for instance, like a surging mob driving itself against a besieged building.

The term "colloidal" defines a state or condition, rather than a form of matter. The term applies to those substances which when distributed in a suitable medium (such as water in the case of soap) will be so finely divided as to be visible only under the ultramicroscope, and the particles of which will not settle out for a considerable period, if at all. As a general rule their presence produces a cloudy or translucent effect. As an illustration, fog and steam are colloidal systems—water distributed in air. Soap added to water gives the latter a milky cast. On the other hand, sugar and salt, both non-colloidal bodies, do not produce the cloudy effect.


1
THE WASHING ACTION OF PURE SOAP is due to both physical and chemical causes
2
PURE SOAP (88% to 94% purity - not soap powders)
DISSOLVED IN WATER hydrolizes to a limited extent
3
WEAK ALKALI is liberated by hydrolysis formed most freely in dilute solutions when heated
5
FATTY ACID Liberated when the alkali breaks away
7
LIQUID SOAP (dissolved but not hydrolyzed to alkali and fatty acid)
8
Wets and Emulsifies
10
BREAKS UP DIRT Colloidal action
4
neutralizes acid dirt
Dissolves Albumins
6
of no value in washing
9
FORMS SUDS to
1 Indicate Active Soap
2 Lubricate
3 Carry Oxygen
4 Remove dirt mechanically
11
FLOATS AND SUSPENDS DIRT
12
SUSTAINS EMULSIONS AND DIRT SUSPENSIONS
HOW SOAP CLEANS

Particles of solid dust or dirt to be removed by the process of laundering vary considerably in size, and it is evident that a noticeable proportion of this dirt will not pass through the meshes of the fabrics to which the dirt is attached.

The usual theory of soiled goods assumes that dirt is fastened to textiles by a film of oil or grease. If sufficiently large or only attached to the surface these dirt bodies would be freed by the removal of the enveloping film of oil. If, however, the particles be very small and entangled within the fibers of the cloth, gravity and chemical action alone will not remove them. Subdivision of this dirt into a finer state is necessary to its successful removal. A soap solution, by virtue of its colloidal state, is capable of disintegrating or pulverizing those grains of dirt which the soap has adsorbed. This breaking up is traced to the Brownian movement, or molecular bombardment of the soap particles.

These minute vibrations, moving as they do without regard for direction, might readily serve to keep the finer particles of an emulsion or suspension in motion or equilibrium, thus largely preventing their coalescence and settling out.

Why Soap Solutions Become Exhausted

Everyone is familiar with the fact that a soap solution becomes exhausted—that is, rendered unfit for cleansing purposes—by passing a considerable quantity of soiled goods through it. For this reason a "second suds" is necessary in washing certain classes of goods. The cause of this exhaustion is easily understood in considering the colloidal adsorption properties of a soap solution.

In the process of adsorption the soap particles, in a certain sense, leave the solution and attach themselves to the dirt. The soap thus adsorbed does not go back into the water (dispersing phase, as it is called), but hangs on to the dirt tenaciously. This is equivalent to taking soap out of the water; or, in other words, weakening (diluting) the soap solution. The soap solution, therefore, weakens or becomes more dilute as the adsorption progresses, until all of the soap has been taken out of the water. The suds disappear and the cleansing value is nil.

After soap is adsorbed it becomes inert and lifeless until restored by proper means. In the laundering process, complete exhaustion is (and should be) prevented by the addition of a slight excess of soap to keep the soap-dirt complexes (combinations) in suspension.

Recovering Soap from Suds Water

The object of the various soap-recovery systems on the market is to take the discharged soap liquors, break the soap away from the dirt to which it is attached by adding excessive quantities of caustic soda, and then mechanically separating the dirt and soap.

THE CLEANSING ACTION OF DISSOLVED SOAP

1. *Produces Alkali in Small Quantity*—
   (a) To neutralize acid dirt.
   (b) To dissolve albumins.
2. *Lowers Surface Tension*—
   (a) To emulsify mineral oils, etc.
   (b) To rapidly wet or penetrate.
3. *Forms Suds (Emulsion of Air)*—
   (a) To indicate active soap.
   (b) To lubricate and cushion cloth layers.
   (c) To carry oxygen.
   (d) To remove dirt by agitation and buoyancy.
4. *Breaks Up and Carries Dirt from Cloth (Colloidal Action)*—
   (a) Valuable on grease-free and oil-free dirt.
   (b) Stabilizes emulsions and suspensions.

The above sums up in chart form the action and value of soap when dissolved in water and used in washing. The diagrammatic chart accompanying this discussion is an original and striking way to illustrate these same properties. We recommend that the reader study it thoroughly, referring meanwhile to the following summary:

1. A small amount of alkali is produced to assist in the neutralization of acid constituents in the dirt, the dissolving of albumins, etc.

2. A low surface tension develops (and low interfacial tension) which is responsible for the valuable emulsifying powers and contributes to the wetting and penetrating properties.

3. A suds is formed due to low surface tension and high surface viscosity of value mechanically and chemically in the process. As an indicator of active soap, suds carries out an important mission.

4. The great and invaluable property of adsorption, coupled with the disintegrating action of the Brownian movement or molecular bombardment, and the stabilizing effect of the latter on emulsions and suspensions.

Dry and Liquid Application

Returning to the use of soap in the suds operation, we recall that there are two general methods of application in use; namely, "dry" or "in solution." The one to be selected is largely a matter of choice. In the use of a soap solution, continued boiling in the soap tank causes some deterioration of the soap, although in practice the slight impairment is not noticeable. The dry method has been found a most convenient one and a labor saver, but the use of a quickly soluble soap is necessary to efficiency.

Powdered soap, by which is meant a pure soap (88 to 99 per cent purity), is a desirable form in which to purchase one's soap, particularly if same is applied to the washer in dry form.

Soap powders, on the other hand, call for some study. Those on the market vary but little in composition, the difference consisting chiefly of a change in the proportions of soda ash and sometimes tri-sodium, bicarbonate and borax, with which the soap itself is adulterated. In fact, the presence of the alkali often conceals the fact of a low-grade soap stock being used. Soap powder, in other words, is an undesirable form in which to buy soap, and a distinction should always be drawn between powdered soap and soap powder.

Pure soap, being an article needed in every washroom, should be bought on a consideration of its pure soap properties—ability to form permanent lather, absence of free alkali, purity, titer, resistance to liberation of free

fatty acid, efficiency at temperatures used in washing, etc. A "sharp" soap may clean a load of clothes more rapidly than a pure neutral soap used alone, but the "sharpness" is an alkaline property. Unless the exact ratio of alkali is known considerable harm may be done to clothing and colors. Consider alkali separately for true efficiency, and whenever alkalinity is desired purchase it in the most desirable form.

A Suggestion

Escolite and Alumina Soapalite are recommended as offering one of the best means of adding to soap the strengthened cleansing properties which are necessary to first-class work. They reinforce, as well as stimulate, the soap. For instance, if an overloaded auto truck is slipping on a grade isn't it better to divide the load with another truck than simply to put on chains? These detergents actually supply extra detersive power, obtained from their colloidal minerals, in addition to the alkaline stimulation of soap. Full particulars are to be given in a later discussion of this series on soap-free detergents.

Dyeing Wool-Silk Materials Different Shades

Dyeing Wool, Leaving Silk Undyed—Dyeing Wool and Silk Different Shades—Recommended Colors—Properties and Application

By GEORGE EMMONS

WOOL and silk are both animal fibers; so that their behavior with respect to dyes is much alike. Sometimes this is a useful property. Sometimes it is not. In illustration of the latter statement may be cited the cases where a wool-silk material is required to be dyed in such a way that the wool is the only fiber really dyed, the silk remaining white. Or it may be desired to dye the wool one color and the silk another. Under such conditions as those given in these two cases, the fact that the two animal fibers behave similarly toward dyestuffs becomes anything but a desirable characteristic. However, there is this to be said, this statement as to similarity of behavior is a general one, and subject to exceptions. It is because of these exceptions that it is possible to carry out practically the program of dyeing fabrics and materials consisting of a mixture of silk and woolen yarns in such a way as to deal separately with the two yarns.

The two fibers are not spun together; but, when spun separately, there are quite a number of materials that consist of a mixture of the two. For example, there may be a plain woven fabric in which the warp consists of yarn of one fiber, and the filling is made from the other. Or the two yarns may be woven together in such a way as to produce pattern effects, the one yarn having one role to play and the other yarn another. Again, there are men's suitings and ladies' dress goods which consist almost entirely of wool, but which nevertheless contain effect threads of silk. Then there are knitted materials consisting of a mixture of the two yarns.

Dyeing the Wool, but Leaving the Silk Undyed

The first thing to settle is whether the silk contained in the material has been properly boiled off. It may have been boiled off only to some intermediate point. It will then contain more or less silk glue, and probably be somewhat yellowish or brownish. If the final effect wanted is a clear white wherever the silk yarn is present, then the dyer should proceed to boil off the goods with the idea of getting rid of the residue of silk glue.

The boiling off may be accomplished in a strong neutral soap bath. The temperature is not allowed to go to the boil. A proper temperature may be regarded as 190 deg. Fahr. Further, let it be noted that the bath is specified as neutral. In particular, an alkaline condition is to be avoided. This boiling-off operation is to be omitted in cases where spun silk has been employed or where the boiling off of the silk has already been carried out.

In the dyeing, two baths will ordinarily be the proper thing. First, one proceeds to dye the wool. A dyestuff is selected which has the property of dyeing the wool at the boil, but of leaving the silk white or approximately white. In general, the dye bath is prepared with the dyestuff solution, Glauber salt and acetic acid. The bath is brought to the boil and the goods entered. The dyeing and boiling are continued for one or one and a half hours, and it is desirable that the bath be strongly acid. A very good way is, first, to start with the bath distinctly acid, and then to keep it so by additions of acetic acid from time to time. The reason more acid has to be added is because there will be losses through evaporation. The following list enumerates suitable dyestuffs for the preceding method:

Naphthol Yellow	Acid Magenta
Tartrazine	Indigo Extract
Xylene Yellows	Alizarin Delphinol SE
Orange 2G	Acid Reds (of the X L Fuchsine type)

These colors dye the wool at the boiling point; but they leave the silk white or somewhat discolored. If the wool is dyed a heavy color, then more or less discoloration is to be expected. Under these conditions, it will be well to treat the goods in such a way as to leave the wool practically unchanged and to clear up the silk.

There are several methods which may be used:

1. A bath of clean, soft water is prepared and heated to 100-140 deg. Fahr. There may be no ingredient, or an addition of a small amount of ammonium acetate. The silk is worked in this bath for a period. One is to expect a certain amount of loss of color on the part of the wool; but, this will ordinarily have no particularly bad effects, provided one operates quickly and uses no more of the ammonium acetate than he can help. The loss of color by the wool may, of course, be anticipated, and provision made when deciding on the amount of dyestuff to use when the dye bath is prepared.

2. Another method of clearing the silk may be followed. One provides a bath of clean water and a supply of compressed air. This air is introduced into the bath at some point in or near the bottom of the beck and is kept going during the treatment. The idea is to keep a supply of oxygen moving through the water. Bran is to be added to the water. A suitable amount will be one and a quarter ounces to each U. S. gallon of water in the bath. The goods are worked in this bath or passed through it several times. Afterwards, they are rinsed well in cold water.

3. A third method of clearing the silk proceeds by preparing a bath with plain water and then adding a small relative amount of hydrosulphite. The bath may be used cold or lukewarm. The goods are worked in this bath and then removed. There is to be some loss of color expected because of the dripping action of the hydrosulphite. This loss may be provided for when dyeing.

Dyeing Wool and Silk Different Shades

After one has dealt with the wool-silk material in accordance with the processes already described, he may go ahead and dye the silk. The preliminary boiling off or clearing after dyeing may, either or both of them, be omitted in certain cases, especially where the silk is to be given a delicate shade, one will do well to carry out the preliminary boiling off and the clearing up procedures with thoroughness.

The silk may be dyed with a basic dye in a cold bath, to which a little acetic acid has been added. The basic dyestuffs are particularly desirable for this proceeding, since they give brilliant and beautiful colors which naturally show up well on the wool background.

Or one may use a direct cotton dye for the silk, a low temperature of the dye bath being provided. The reason the direct cotton colors are thus usable turns on the fact that they dye silk well at low temperatures, while they have little or no affinity for the wool at temperatures below 100 deg. Fahr. (38 deg. Cent.). Indeed, many direct cotton colors will not affect the wool at higher temperatures. The dyer should, in the absence of information permitting him to use such higher temperatures, play safe and do the dyeing cold.

The list of dyestuffs already given as enumerating dyes suited to dyeing wool in a boiling bath and leaving the silk unaffected may be considerably extended. I list the following:

Acid Green	Fast Light Yellow 3G
Acid Violet 3RS	Fast Red NS
Acid Yellow G	Fast Yellow S
Acid Yellow AT	Flavazine T
Alizarin Blue SAP	Guinea Red 4B
Amaranth	Indigo Extract
Benzyl Red S	Indigo Carmine
Bordeaux S	Mars Red G
Brilliant Cochineal 2R	Naphthylamine Black
Brilliant Scarlet 4R	New Coccine
Cochineal Scarlet PS	Orange II
Crystal Scarlet 6R	Sorbine Red
Cyanole FF	Victoria Rubine O
Eosamine B	Victoria Scarlet 3R
Eosin 3G, RN	Victoria Violet 4BS

In addition to this list and the short one at the beginning of the article, it will be well for the dyer to be advised of suitable dyes for dyeing the silk in a cold acid bath without affecting the wool. I enumerate the following acid dyes which have this property:

Acid Green	Mandarine G
Acid Magenta	Methyl Blue
Acid Violet 6BS	Milling Red FR
Amaranth B	Naphthol Blue Black
Brilliant Croceine	Naphthol Blue G
Brilliant Milling Blue B	Naphthol Red O
Croceine AZ	Ponceau 1ORB, 4RB, 2GB
Fast Acid Green BN	Tetra Cyanole V
Fast Acid Magenta G	Victoria Rubine O
Fast Blue, B, R	Violamine G, R, B
Fast Red Extra	Water Blue B
Guinea Green B	Wool Blue
Guinea Violet 4B	Wool Blue TB

In addition to these dyes, we have already had cited the basic dyes and the direct cotton colors. These are suitable for dyeing the silk in a cold, or nearly cold, bath and leaving the wool relatively unaffected. I enumerate the following basic dyestuffs as suitable for coloring or shading the silk and leaving the wool undyed. A small amount of acetic acid and a cold dye bath are to be remembered:

Auramine	Methylene Green
Bismarck Brown	New Blue D

Brilliant Green	Paraphosphine G
Brilliant Safranine	Rhodamine B, G, 6G
China Green	Rhoduline Red B, G
Chrysoidine F	Rhoduline Violet
Cotton Green	Rubine
Ethyl Green	Safranine
Janus Gray B	Solid Green
Janus Red B	Tannin Heliotrope
Malachite Green	Tannin Orange R
Methyl Violet	Thioflavine T
Methylene Blue	Turquoise Blue 2B G

It may not be inadvisable to deal individually with a few of the dyes mentioned in the foregoing. Refer, please, to the first list, where a short enumeration is given of dyestuffs suited to dyeing the wool in a strongly acid bath. A boiling bath and a prolonged dyeing at the boil are used. The silk is left unaffected or but slightly affected.

Naphthol Yellow is the first on the list. There are a number of other dyestuffs more or less closely related to this dye, which may be regarded as similar in their behavior. I mention: Martius Yellow, Manchester Yellow, Naphthalene Yellow, Naphthylamine Yellow, Aniline Yellow. Naphthol Yellow is dyed after the manner of Picric Acid when used as a dyestuff. However, one needs perhaps less acid in the dye bath. That is, with Naphthol Yellow, a proper amount of acetic acid is 3 to 4 per cent. Too much acid is liable to promote unevenness of shade. The wool is entered when the bath is still cold. The temperature is pushed up to the boiling point in fifteen minutes, after which the dyeing is accomplished by continuing at the boil for another fifteen minutes. Naphthol Yellow produces shades ranging from lemon-yellow on to orange-yellow. These colors are not fast against milling nor against rubbing. The dye is, accordingly, not recommended for hosiery. The shade is moderately fast against light and air. Upon exposure, the shade fades more or less and becomes duller. However, apparently it soon comes to a limit, and afterwards does not undergo much change. Naphthol Yellow is pronounced volatile and is said to evaporate from the fiber, even in the temperature of ordinary summer.

Tartrazine is a bright yellow dye. It produces shades which are quite fast against light, fairly fast against washing, and have a good fastness against acids and alkalies. It is considered a splendid acid dye. From 2 to 4 per cent of sulphuric acid is to be employed. Glauber salt is used in amounts ranging from 10 to 30 per cent. Or, instead of Glauber salt, one may substitute 5 to 10 per cent of sodium bisulphate.

Orange 2G (or G) is another acid color. It is very fast against light. As to washing, it is faster than quite a number of other orange acid azo colors. That is to say, it has a good degree of this type of fastness. Besides, it is not sensitive to acid or alkalies, and has the admirable quality of facilitating evenness of shade. This dyestuff may be applied to wool in an acid bath in which is an addition of 5 per cent of sodium bisulphate, or 2½ per cent of sulphuric acid. The color solution is added and also the acid. The goods are dyed at the boil. Afterwards they are washed and dried.

Acid Magenta is an acid dye that tends to go on the wool in a level manner. It does not rub and is moderately fast against milling. Alkalies discolor it. And it is not fast to light. However, the fastness against rubbing is an excellent quality, particularly for hosiery, as a color that does not rub should not crock. At the same time, hosiery may be more or less exposed to alkaline dirt from the streets.

Orange II is a popular acid color which may be used to dye the wool at the boil. It levels well, which is admittedly a fine quality in a dyestuff. It produces a reddish shade of orange. It is not sensitive to alkalies nor acids, and is fairly fast against light and washing.

Cochineal Scarlet PS is a color belonging to the acid series which produces a brilliant scarlet that is as fast to light as cochineal itself. It is moderately fast against washing, and is fast against acids, alkalies and stoving. It has a fair tendency to level well.

Cyanol FF is a good blue dye of the acid series.

An examination of the lists enumerating dyes suited to dye wool in a boiling acid bath when the silk is left substantially unaffected, and the list of dyes adapted to dye the silk in a cold acid bath when the wool is left practically unaffected—a comparison of these two lists will show some duplications. I mention the following:

Acid Green
Acid Magenta
Victoria Rubine O

The explanation turns on the temperature. The wool is dyed at the boil; the silk is dyed cold.—Silk.

TREMENDOUS GROWTH OF SILK INDUSTRY IN THE UNITED STATES

The silkworm has apparently not heard that the war is over. At least it is a fact that the prices which Americans are still compelled to pay for this product, four years after the close of the war, are nearly two and one-half times as much per pound as the annual average prior to the war. The latest full month figures of the Department of Commerce, those of August, 1922, show the average import price of the raw silk entering the country in that month at $7.14 per pound, against an annual average of $3.15 per pound in 1913.

Curiously, too, the quantity of silk being brought into the country even at these spectacular prices of over $7 per pound is approximately twice as great as in 1913, when the price was less than half that of to-

day. Silk experts estimate that the quantity of raw silk entering the United States in the full year 1922 exceeds by 25 per cent that of the former high record year, 1921; if so this would bring the 1922 total to 56,000,000 pounds against 28,000,000 in 1913, and 45,000,000 in 1919, when the silk factories of the country turned out $688,000,000 worth of silk goods against $254,000,000 in 1914, and $107,000,000 in 1900. The total value of silk goods manufactured in the United States in 1919 was six times as great as that of 1900.

These values of the silk goods turned out by the factories of the country from year to year are, it must be remembered, those at the factory and by no means represent the sums paid by the consuming public. In fact, the head of a great silk manufacturing establishment of the United States is reported as estimating that over $1,500,000,000 worth of silk manufactures were sold in the United States in 1922, and that the total for 1923 will be still larger.

The United States has become by far the largest silk consuming and manufacturing country of the world, despite the fact that all of the raw material which we use in this line is brought half-way around the globe, and experts are quoted as saying that we are to-day importing 80 per cent of the raw silk of the world and using practically all of it in our own factories, for the quantity re-exported in the natural state is negligible.

This big increase in the outturn of our factories means that we are building up a considerable market abroad for the manufactures produced from this imported material. The value of silk manufactures exported from the United States in the calendar year 1920 was approximately $27,000,000 against a little over $2,000,000 in the year preceding the war and, while, of course, the 1922 figures are materially below those of 1920, the total value of silk manufactures exported in the calendar year 1922 is approximately six times as much as in the year preceding the war. Silk goods produced in the factories of the United States now go to over sixty countries and colonies, including considerable quantities sent to the countries from which we draw our raw silk—China and Japan.

The capital invested in the silk manufacturing industry of the United States was reported by the census of 1920 at $533,000,000, as against $210,000,000 in 1914, and $81,000,000 in 1900. The sum paid in wages in the silk industry in 1919 was $108,000,000, against $47,000,000 in 1914, and $20,000,000 in 1900.

SULFOGENE BRILLIANT GREEN 4GX AND PONTACHROME BLACK T IS ANNOUNCED BY DU PONT

E. I. du Pont de Nemours & Co., announces placing on the market a new product, Sulfogene Brilliant Green 4GX.

This color means an addition to this firm's already very broad line of Sulphur colors. It produces extremely bright yellowish shades of green, yellower than Sulfogene Brilliant Green 2G previously offered, and slightly brighter. This new brand is easily soluble and dyes very evenly, being especially suitable for beam dyeing machines; or can be used in a circulating machine and for padding. It is expected that it will be used extensively for self-shades as well as in combination with other Sulphur colors, as it is equally well suited for use on raw stock, yarns, tops, piece goods, and hosiery.

Its fastness to cross dyeing, washing, light, alkali, mercerizing, water, etc., is very good, making the color desirable for dyeing washable fabrics for such materials as awnings, upholstery, etc. On artificial silk the color produces a very brilliant yellowish green.

The du Pont company also announces placing on the market a new chrome color under the name of Pontachrome Black T, which is of the same group as Pontachrome Black A recently offered.

Pontachrome Black T produces jet blacks of very good fastness; it stands severe potting without changing shade or bleeding into white, and has been generally used extensively on yarns, raw stock, slubbing, tops, pieces, etc., where fastness is demanded. It also stands severe alkaline fulling, washing, scouring, steaming and milling, and is highly recommended for all kinds of woolen goods which must resist not only the ordinary wear; but at the same time it is not affected by the usual processes of manufacture. It has good solubility and therefore dyes evenly, being well adapted for machine dyeing, and is one of the best blacks for Vigoreaux printing.

NOTICE OF A. A. T. C. C. CHANGES IN ADDRESSES

The following changes in address of members should be noted:

Baxter, John J., c/o Hudson Dyeing Company, Hudson, Mass.

Burchill, Daniel, 132 Kearney Street, Paterson, N. J.

Fiebiger, Peter, U. S. Appraiser's Stores, Room 1002, 641 Washington Street, New York City.

Gainey, Frank W., 1 Kingston Street, Lawrence, Mass.

Lewis, L. C., c/o John Doherty Silk Company, Clifton, N. J.

MacIntyre, J. F., 240 East Market Street, Greensboro, N. C.

Palizza, Louis, 18 Taylor Street, Providence, R. I.

Roberts, Herbert C., Box No. 55, Norwood, Mass.

Roos, Louis J., Dupont Company, 274 Franklin Street, Boston, Mass.

Washburn, J. Milton, 266 Pine Street, Lowell, Mass.

Lewis, L. C., Henry Doherty Silk Company, Clifton, N. J.

Goldthwait, Charles F., Baltimore Processing Company, Thirty-sixth and Benson Streets, Baltimore, Md.

Schwarz, Herman L., 26 North Terrace Avenue, Mount Vernon, N. Y.

A HISTORY OF THE CHEMISTRY OF THE MORE IMPORTANT NATURAL DYES

(*Continued from page* 164.)

shade which is exceptionally fast when properly dyed. The brazilin, differing chemically only slightly from hematoxylin, gives red shades which are not so fast to light, etc. This is the principal reason why hypernic extract is not used to such a great extent, being practically supplanted by the artificial colors; although fair quantities of hypernic extracts and crystals are used in leather dyeing, lake manufacturing and pigment manufacturing. However, a new use has been found for hypernic extract in the replacing of Alizarine in the production of the sepia tone in the pictorial sections of Sunday newspapers.

Chemistry of Fustic

Of the yellow dyes found in nature, Fustic is by far the most important. It is also called Cuba wood and Old Fustic, and is known botanically as Morus tinctoria. Fustic is found in Mexico, Jamaica, Cuba, Costa Rica, Nicaragua and Haiti. The wood from each country has different properties from an extract manufacturing point of view, and gives shades from greenish to reddish yellow, according to the country of origin. In comparison with Logwood, it takes, as a rule, thirty to forty years before it is suitable for shipment. The use of Fustic dates back to the discovery of America, and it has remained, with Logwood, the most important of natural dyestuffs.

Chevreul, too, was the first to study the coloring principles of Fustic. He found two substances, one sparingly soluble in water and the other more readily soluble in water. The first he called morin. Later on, Wagner carried on Chevreul's work and verified his results. Wagner called the more readily soluble substance morintannic acid, expecting that the latter had a composition similar to morin. But Hlasiwetz and Pfaundler (Ann., 127) proved conclusively that the so-called morintannic acid was entirely different from morin in properties as well as in chemical composition; in fact, it was not an acid. They changed the name of the substance to maclurin.

Morin, $C_{15}H_{10}O_7$, is present in the wood, partly as such and partly as a calcium salt. Benedict and Hazura found a method to isolate morin and maclurin, which Perkin improved. The latter added a solution of lead acetate and acetic acid to the boiling extract of the wood. The morin was thereby precipitated as a yellow lead compound, whereas the greater portion of the maclurin remained in solution. After washing the lead morin it is made into a thin paste with water and poured into boiling dilute sulphuric acid. The resultant liquor, after decanting from the lead sulphate, is allowed to cool, and the crude morin crystallizes out with a yellow-brown color. This crude product is purified by dissolving in alcohol and the solution heated, and one-tenth of the volume of hot water is added. After cooling, the crystallized morin is filtered. This procedure is repeated until no further precipitate is produced, when water is added. Even then, Perkin found that these morin crystals contained some maclurin. He treated the pure morin with acetic acid and hydrobromic acid, thereby forming a hydrobromide. The latter he suspended in hot glacial acetic acid and decomposed the hydrobromide by the addition of boiling water.

Separation of Morin and Maclurin

Lowe, later on, found that by allowing a commercial Fustic extract to stand for some time it deposited a brownish yellow powder consisting principally of morin and its calcium salts. By boiling this water with a little hydrochloric acid, the calcium salt of the morin was decomposed, and by extracting with boiling alcohol and evaporating the alcoholic solution he obtained large quantities of crude morin.

As previously mentioned, the morin is separated from the maclurin by precipitating the morin as a lead compound, leaving the maclurin in solution. This solution is treated with sulphuretted hydrogen to remove the lead, evaporated, and the resultant substance extracted with ethyl acetate, which dissolves the maclurin. The crude maclurin is then purified and crystallized from dilute acetic acid. The researches conducted by many chemists on morin and maclurin have proved that they belong to two different groups.

Morin, $C_{15}H_{10}O_7$, belongs to the flavonole group, whereas maclurin, $C_{13}H_{10}O_6$, belongs to the benzophenone group.

Properties of Fustic

What has been said regarding the excellent properties of Logwood can be said of Fustic. It is the most valuable yellow dyestuff, natural or artificial. On wool as a self-color it gives on chrome mordants old gold shades. On copper and iron mordants it gives olive shades, all of which are extremely fast to light and milling. However, it is mainly used with other colors, such as Logwood, Alizarine, etc., for toning purposes. In silk dyeing it is used principally as a mordant in conjunction with copperas and bluestone. Large quantities are used for dyeing yellows and browns on leather and kid, and as a bottom on chrome-tanned leather for basic coloring matters.

Osage Orange

Another yellow natural dyestuff which has recently become of commercial importance is Osage Orange. It had been used by the Indians for many years in the Red Valley, Texas, but only to a small extent. The

coloring principles are the same as Fustic—namely, morin and maclurin—but there is an absence of a red coloring matter which is present in Fustic to a small extent. It can be used in the same manner as Fustic, but owing to its limited supply and the distance the wood has to be carried by rail, with expensive freight rates, it will never be able to compete with Fustic.

Quercitron

Another important natural yellow dyestuff is Quercitron bark. It is the inner bark of an American oak, Quercus tinctoria, which grows extensively in Pennsylvania, Virginia, Georgia and the Carolinas. The celebrated Bancroft discovered the value of this bark as a dyestuff in the year 1775, and by act of Parliament he obtained the exclusive right of importing it into Great Britain for a period of six years.

Quercitron bark products are placed on the market in the form of extracts and a powder called flavine. There are two distinct types of extract, one of which gives lemon-yellow shades and the other orange shades. The product which produces orange shade is manufactured from the pure extract by the acid hydrolysis of the glucoside quercitrin present in the extract, to quercetin.

The flavine is practically the pure coloring principle of the bark and comes into the market in the form of a buff-colored powder. There are several varieties, some of which consist of nearly pure quercitrin. Some are mixtures of quercitrin and quercetin, while others are principally pure quercetin.

Isolation of Quercitrin

Here also we find Chevreul as the pioneer investigator of the coloring principles of bark, although Bancroft before him had tried in vain to find the real coloring matter. Chevreul isolated from a decoction of Quercitron bark a crystalline body which he called quercitrin. Other chemists took up Chevreul's investigations and the result of their work was the glucoside of the bark being extracted from it by water and then hydrolized to quercetin.

Perkin obtained pure quercetin by first macerating the bark with a salt solution in order to remove the gummy substance. The bark was then extracted with ammonia water. The cold ammoniacal solution is acidified with hydrochloric acid, whereby many impurities separate in the form of a brown precipitate, which is filtered off and the acid filtrate is boiled for half an hour. In this way the glucoside is hydrolized and almost chemically pure quercetin, in the form of pale yellow needles, is obtained. These are filtered off and washed with water. It has been proved that quercetin has the formula $C_{15}H_{10}O_7$, and belongs to the flavonole group.

Quercitron bark gives, on mordanted cloth, identical shades to Fustic, and the method of dyeing is practically the same. It is extensively used in cotton duck dyeing, wool dyeing, lake and pigment manufacturing. It is also used in tanneries for the toning down of hemlock tannages, and for the preparation of the methyl pentose sugar known as Rhamnose. C. F. Walton, of the Carbohydrate Laboratory of the Bureau of Chemistry, carried out a few years ago some interesting work in connection with the preparation of this rare sugar from Quercitron bark.

Turmeric

Turmeric, which was formerly used in dyeing, is the tuber of a plant of the species Curcuma, which grows abundantly in the East Indies. The roots are ground and yield a bright orange powder which has a strong odor and a bitter, aromatic taste. It is one of the few substantive dyestuffs, and dyes cotton, wool and silk a bright yellow shade which, however, is fugitive to light. In the feather-dyeing industry it is still used in conjunction with Logwood, but the greater proportion of it is used in the manufacture of condiments. In India it is used for coloring rice.

Cutch and Gambier

Of the brown dyes found in nature, cutch and gambier are by far the most important. They are very similar to each other in their properties, being tannins. They are imported from India and Singapore in the form of a chocolate-brown-colored solid extract. Gambier is occasionally imported in the form of cubes. They are manufactured by the natives, and from what we know of the process it is extremely crude and destructive. These products are used principally in cotton and silk dyeing, and for the preservation of fishing nets. The shades produced on cotton are extraordinarily fast, and are used on materials which are subjected to harsh treatment.

S. W. JACOBS NOW GENERAL SALES MGR. FOR ELECTRO BLEACHING GAS CO.

Electro Bleaching Gas Company, manufacturers of liquid chlorine, announces the advancement to general sales manager of S. Willard Jacobs, succeeding D. K. Bartlett, as of January 1.

Mr. Jacobs is a chemical engineer of extensive training and has done much to advance the use of liquid chlorine in the many industries in which it is now used. Aside from his work as a consultant on the matters pertinent to the use of liquid chlorine, he has supervised the installation of a number of chlorine plants and has gained a considerable reputation because of his ability in this field.

Those who know him personally, or are familiar with his work, will wish him well in the increased scope of his activities and responsibilities.

Disputes in Relation to Textile Fabrics

(*Concluded from page* 147.)

Shortsighted Selfishness—Bad Advice—Faults in Fabrics—Textile Perfection Impossible—Faults Crop Up Late—Carding—Weaving Faults—Dyeing and Finishing Faults—Disputes—Legal Decisions—Conference—Procedure—Matters Which May Be Referred to Arbitrators—Submission and Its Importance—Time Limit—The Award and Cost of Proceedings

By A. MITCHELL BELL

A paper read to the Halifax branch of the Foremen Dyers' Guild on March 7, 1922. *Copyright of the Guild* *Printed in the Dyer and Calico Printer*

Dyeing and Finishing Faults

In the process of dyeing and finishing, faults in the form of striations, creases, stains, etc., are created, and the causes of which no doubt you gentlemen will be even more familiar with than your lecturer will be. One of the most interesting cases I have had to investigate has been one that was placed in my hands quite recently. The fabric had a shot effect, and contained longitudinal striations showing slight variations of the different colors, and on first glance seemed to suggest that it was a manufacturer's fault; but after a thorough investigation it was found that one of the colors had loosened a little and run mostly at those places where there had been extra pressure caused by the many creases formed and reformed as the piece was being passed through the wet processes.

Another interesting case of a different nature was one of a piece-dyed serge, having very narrow bars across and all the way throughout the piece. These bars appeared very like faults occasionally formed by differences in yarn and certain weaving faults, but on investigation were found to be created in the finishing operations; and by being treated again by a different finisher the fault was eliminated on some of the pieces which were not of the worst type, and very much mitigated even in the worst pieces in the number, proving that the real cause had been located and remedied.

Disputes

When disputes arise and become of an acute nature, there are three methods of dealing with them to arrive at a settlement, which are as follows: (a) By conference between the parties concerned in them; (b) by submitting them to arbitration; (c) by taking the dispute before a court of law.

In my judgment these methods are placed in their order of importance and should be taken in that order if at all possible, because it is the most natural and reasonable. The third method should not be resorted to unless all other means have failed, and only adopted when fully compelled to do so by the opposing parties. It cannot be denied that a large majority of trade disputes that have in the past been taken into court have often had a most unsatisfactory ending and have left an unpleasantness between the parties concerned for a considerable time afterward, while in a few instances they have been the cause of all trade relationships being broken off between them for all time.

Legal Decisions

The most disappointing feature is that many of these cases have been lost merely on a point of law when, from the moral point of view, they should have been won outright. It has been my contention for a long time that when trade disputes of the nature herein described are being tried in court they should be heard by a judge well versed in the whole facts of the case, or he should be assisted by one or more who are themselves thoroughly acquainted with the trade's terms, customs and practices.

In a lecture given a short time ago before the Bradford Textile Society, J. J. Wright, a Bradford barrister, when speaking on "Sales by Sample or by Warranty," said: "I am also mystified that so many cases are fought in our law courts before judges and juries, unlearned and ignorant even in the mysterious nomenclature of, say, the Bradford trade, with its tops, noils and yarns, its preparing and carding and combing, its feeding, condensing and spinning, and thousand other trade terms. If I had my own way, no trade case should be tried before a jury, and it should be compulsory that a judge should be assisted by two expert assessors sitting with him in court."

When one who is versed in the law as Mr. Wright must be makes a statement like the one just quoted, one who is only a layman may be forgiven for suggesting such a course as the above. The moral must be then in connection with disputes of a trade nature in relation to textile fabrics, to keep it out of the law court, and arrive at a settlement without its aid if it is at all possible to do so.

Conference

The first method of dealing with disputes, viz., by conference between the conflicting parties, is by far the best and should be adopted. There is not the slightest doubt that many or most of the minor troubles could be prevented from arriving at a disagreeable stage if

they were tackled in the spirit suggested in the earlier stage of my lecture, i. e., being approached by all parties concerned in a reasonable and conciliatory spirit without the aspect of the one trying to steal a march upon the other. When the difficulties cannot be surmounted without outside aid, the next best method is to submit them to arbitration, as this is in the majority of cases more satisfactory than appealing to the courts for a decision. I approach this branch of the subject in the character of a lay mind, although I have acted on many occasions as consultant and adviser, and on a few occasions in the capacity as an arbitrator.

The usual method in the trade and the one which is preferred mostly by contesting parties is for each to select a suitable person who understands the matter thoroughly, possessing an unbiased and reasonable mind and attitude, to act for them, both the persons being acceptable by all concerned. This, although it appears at the first glance to be the most reasonable thing to do, will after a little consideration be shown to be not the wisest course to adopt, because in the very nature of things each of the arbitrators may be led to feel that he is to look more after the interests of those by whom he has appointed, rather than to act as judicator on the material and moral conditions with which the case is surrounded. It must here be understood that although the case is being dealt with out of court and without the strict legal aspect of the law, it is after all somewhat in the nature of a legal investigation, and judgment must be passed within the limits of the submission containing all the facts of the case upon which they are to arbitrate upon and to make their award. The method of procedure is somewhat as follows:

Procedure

1. The agreement of the parties to submit their dispute to arbitration.

2. The appointment of the arbitrator or arbitrators. Wherever possible it is best to appoint one arbitrator who will be acceptable to both parties concerned, because when two or more are appointed by the respective parties it invariably leads to possibilities of a deadlock or some point of difference which necessitates the aid of a third, and in whom the settling of the point of difference rests, and who has to make the final award. This leaves the final decision to one person, because as soon as the arbitrators have to submit their findings to the umpire it passes practically entirely out of their hands, hence the advisability of electing only one arbitrator, wherever possible, and especially when he is known to be a capable, reasonable, and fair-minded person, and whom they have confidence in to act justly to all parties, and willing to receive all evidence bearing upon the case and that comes within the range of the limits contained in the submission that was placed in his hands at the commencement of his arbitration duties.

Matters Which May Be Referred to Arbitrators

Mostly all matters that may be subject to civil litigation may be referred to arbitration, and certainly all matters in connection with disputes in relation to textile fabrics may thus be referred to this mode of obtaining a settlement. All the exceptions that I can find do not include any within the nature of the title of this lecture.

Submission and Its Importance

One very important matter is the submission, and the greatest care possible should be exercised when it is being drawn up, because it is essential that it should contain all the salient facts of the case in dispute, and that everything else outside the case should be absent, because it circumscribes the extent and limit beyond which the arbitrator has no power to go, and upon what it contains depends the final judgment and the making of his award.

The arbitrator has the power to demand any written or verbal evidence that may be necessary to assist him to arrive at a just conclusion. On the other hand, the parties concerned have the right to call in persons to give evidence on their behalf, and the arbitrator is bound to hear any evidence that may be put forward, but only in the presence of both conflicting parties.

If counsel is being brought by one party to give evidence then notice must be given in writing to the opposite party so as to give them the opportunity of doing the same if they should desire to do so. In every case notice must be given of all who are to be brought forward to give evidence before the arbitrator, but he is the one to decide whether it is relevant or irrelevant to the case in question.

Time Limit

Unless a time limit is stated in the submission for hearing, arbitrating and making the award, the usual time is three lunar months, but the arbitrator has the power to extend the time if he finds it advisable and necessary, but he must notify the parties concerned of his doing so.

Also if two or more arbitrators are appointed and no umpire is mentioned in the submission, then they have the power to appoint an umpire, and the usual procedure is to make the decision before commencing upon the arbitration, although it does not prevent this being done at a later stage, when a deadlock has arisen in the proceedings, and especially if the time has not expired in which they are required to make the award. The appointment of the umpire must be made and signed by both arbitrators in the presence of each other, or otherwise the appointment will be invalid. The appointment of an umpire if accepted by the persons cannot be revoked or affected by the subsequent

dissent of the parties. The umpire may make his award within the time limitation stated in the submission; if none stated, then within one month of his taking up the duty, unless he extends the time by giving written notice of any extension.

The Award and Cost of Proceedings

The arbitrator, arbitrators or umpire has not only to make the award and to draw up the award, but also has the power to assess the costs and to decide by whom they shall be met.

It is essential that the award be drawn up in as clear and concise a form as possible so that the conditions and terms can be readily understood and acted upon. When the award is made and drawn up the arbitrators notify the parties that it is ready, and either party can receive the same on payment of the costs, and should the party who is not liable for the costs apply for it and have paid the costs they can demand payment from the opposite party. If they should refuse payment of those costs, and are not willing to meet the requirements of the award, then they may be sued in court for the same, with the most favorable chance of adding much heavier costs to their already obligation.

In the case of a reference by consent out of court, a valid award is final and binding on the parties and privies, and is conclusive as to the matters submitted, debarring the parties both from appeal and from again litigating the same subject matter.

In conclusion let me state that in my opinion the method of submitting disputes or points of difference between parties in the trade in relation to goods has in most cases a far more satisfactory result when placed before competent and judicious arbitrators than when these cases are taken to court, and should strongly advise all those connected with them to be willing to do so, especally when they have got beyond the stage of a settlement being arrived at by conference between themselves.

The Use of Chromium Compounds for Mordanting and Dyeing

Dye Making—Reduced Chrome—Acid Dyestuffs on Cotton—Chrome Alum—Chrome Acetate—Analysis of Chrome Alum—Reaction of Chromium Compounds—Chromates

By A. J. HALL

CHROMIUM compounds have long been used in the dye and textile industries, and it will be remembered that it was with the aid of potassium bichromate that Perkin discovered the first coal-tar dyestuff. On that occasion Perkin was endeavoring to prepare quinine by oxidizing aniline with a mixture of a bichromate and sulphuric acid. Instead of quinine he obtained a dark-colored product which many chemists, under the circumstances, would probably have thrown away. Perkin, however, did otherwise, and so laid the foundation of the present dye industry and his own fame and fortune. He extracted from the product, by means of organic solvents, a colored substance capable of dyeing silk. It was the first coal-tar dyestuff, and with Pullar's (of Perth) encouragement and Perkin's genius it was made on a large scale and was largely used under the name of Mauveine.

Dye Making

To-day, bichromates could scarcely be replaced in many fundamental processes of dye manufacture which involve the use of oxidants. Sodium bichromate is essential to the manufacture of anthraquinone and Methylene Blue. But chromium compounds have become no less important in the dyeing industry itself. Chrome mordants are more largely used than any other mordant for wool, and each year large quantities of bichromates are used for the after-treatment of aniline black dyed fabrics in the printing of cotton fabrics and the production of mineral khaki on cotton goods.

The use of chromium as a mordant for wool originated some forty years ago, when the Badische Soda and Anilin Fabrik sought a suitable method for applying, to wool, two new dyestuffs—Alizarine Blue (dioxy-anthraquinone-quinoline) and Alizarine Black (naphthazarin or dioxy-napthoquinone). At that time these dyestuffs were introduced as substitutes for Indigo and Logwood, and they were applied to wool in conjunction with the use of potassium chromate and tartaric acid.

Reduced Chrome

Subsequently, tartaric acid was replaced with sulphuric acid. At a still later date, oxalic acid was brought into use. Very pleasing and pure shades were obtained on wool mordanted with chromium fluoride and oxalic acid. Finally, in 1896, mordanting by means of an alkali chromate and lactic acid was shown to yield excellent results.

The use of organic acids in these processes is beneficial, since it is generally found that the best dyeings are obtained on a chrome mordant which partly consists of a reduced chromium oxide. Why reduced chrome mordants are thus beneficial it is difficult to say. Probably, however, the explanation lies in the fact that an unreduced mordant is liable to oxidize the dyestuff absorbed and so alter its shade. In this connection reference may be made to an interesting paper by Craven. In this paper some experiments relating to the dyeing of chrome-mordanted wool with hematin are discussed, and it is concluded that with this dyestuff the best shades are obtained when the mordant is in a reduced form. With hematin, a reduced chrome mordant yields shades which are faster to light and brighter in tone than those obtained on wool mordanted with yellow or unreduced chromium oxide. Moreover, these brighter shades are also faster to rubbing.

Unlike wool, cotton has no useful affinity for chromium under ordinary conditions. Hence special methods for mordanting cotton have been devised. The simplest method is to pad the fabric with a suitable chromium salt, afterwards dry it, and then pass the fabric through a boiling solution containing sodium carbonate. Preferably a basic chromium salt should be used in this process so that possible tendering of the cotton is then reduced to a minimum. In another process a mixture containing a soluble bichromate and a sulphite, together with ammonia (for the purpose of rendering the mixture stable) is padded into the cotton fabric, which is then dried and steamed. As the ammonia is driven off the sulphite reduces the chromate and the fabric becomes mordanted with chromium.

A third process for mordanting cotton with chromium involves the use of Koechlin's alkaline chrome mordant liquor, and in connection with this Pokorny has published some very interesting facts. This mordanting liquor essentially consists of a solution of chrome oxide in strong caustic soda, and it mercerizes at the same time as it mordants. It may be prepared by pouring a cold solution consisting of one part of chrome alum dissolved in five parts of water, into three and a third parts of caustic soda of 12 deg. Tw., whereby a dark green liquor of 32 deg. Tw. approximately is obtained. When cotton fabric is padded with this liquor and allowed to lie, chromium becomes fixed within the fibers and is not removed in the subsequent washing.

Acid Dyestuffs on Cotton

But in addition to its mordanting action this liquor confers some interesting properties on cotton. For Pokorny finds that the mordanted cotton very readily absorbs acid dyestuffs. In fact, the mordanted cotton can be dyed from cold acid dye baths with almost any wool or silk dyestuff. The fastness of the shades obtained, of course, varies considerably. But in some instances, such as Eriochrome Azurol B and Alizarin Saphirol B, the shades are quite fast to a hot soaping. Where the resulting shades are loose they can sometimes be improved by subjecting the dyed fabric to a short steaming.

The mordanted cotton also has an affinity for diazo and tetrazo compounds. Hence when steeped in a solution of a diazotized amine, the fabric may then be lightly rinsed and immersed in a solution of a suitable hydroxy compound, whereby the resulting azo dyestuff becomes firmly attached within the cotton fibers. Interesting is the fact that alkaline chrome mordanted cotton may be dyed a dark indigo shade from a cold dilute dye bath containing Diamine Sky Blue.

Before considering the further application of chromium in textile treatment, mention should here be made to the methods by which the most frequently used chromium salts are prepared.

Nearly all chromium compounds are manufactured from chromite or chrome iron ore, $FeO.Cr_2O_3$. This ore is roasted with lime and sodium carbonate in the presence of air and is thereby transformed into sodium chromate, Na_2CrO_4, which is dissolved out from the roasted mass and then further converted into sodium bichromate by addition of sulphuric acid..

$$2Na_2CrO_4 + H_2SO_4 = Na_2SO_4 + H_2O + Na_2Cr_2O_7.$$

The solution of this substance is concentrated, is then filtered from the less soluble sodium sulphate and is then allowed to stand so that the more soluble sodium bichromate gradually crystallizes out.

Sodium bichromate, $Na_2Cr_2O_7.2H_2O$, can easily be converted into the potassium salt, $K_2Cr_2O_7$, but nowadays, owing to its greater solubility and cheapness, it is the sodium compound which dyers most frequently use. Moreover, nearly all other chromium salts are indirectly or directly manufactured from the bichromate.

As is well known, sodium bichromate is an excellent oxidizing agent and as such is very largely employed. But wherever possible oxidation should be effected with a chlorate, since this is a much cheaper oxidant. This fact will be better appreciated by reference to the following equations which show how these two substances decompose and liberate their oxygen:

$$Na_2Cr_2O_7 = Na_2O + Cr_2O_3 + 3O.$$
$$NaClO_3 = NaCl + 3O.$$

Thus when used in equimolecular quantities, sodium bichromate and sodium chlorate have equal oxidizing powers. From this it can easily be shown that sodium chlorate as an oxidizing substance is about five times as cheap as sodium bichromate.

On account of its oxidizing power sodium bichromate is largely used in the aftertreatment of aniline blacks for the purpose of rendering them ungreenable. It is generally agreed that the chrome liquor should

preferably be neutral, but it is not certain whether this neutrality influences the process of oxidation alone or whether it also influences the amount of chromium which is fixed within the fabric. At any rate, it is probable that under neutral or alkaline conditions more chromium will remain in the fabric, probably attached to the aniline black, and will therefore modify its shade and stability.

A similar fixation of chromium occurs when sulphur dyed fabrics are afterchromed for the purpose of developing their full shade, or in the case of blacks, for preventing aftertendering. Also the increased fastness to milling and washing which is conferred on certain direct dyed cotton fabrics by an aftertreatment in a liquor containing a bichromate and acetic acid, is most probably due to the chromium-dyestuff lake thereby formed.

Chromium compounds are also largely used in the production of mineral khaki. For although the demand for this shade has largely decreased since the war, mineral khaki is not at all fast to acids.

The principal chromium salts used in this style of dyeing are chrome alum, chromium acetate, and sometimes chromium sulphate.

Chrome Alum

Chrome alum is essentially a double salt. It always contains chromium sulphate, but may contain, as a second component, either sodium, potassium or ammonium sulphate. These salts are represented by $K_2SO_4.Cr_2(SO_4)_3.24H_2O$—the formula of potassium chrome alum. Generally, however, the potassium and ammonium chrome alums are met with in dyeing practice, since manufacturers find it much more difficult to prepare the corresponding sodium chrome alum in a crystalline state.

Potassium chrome alum may readily be made by reducing potassium chromate or bichromate with glucose in the presence of sulphuric acid. Various organic matters are formed at the same time, so that, though the product may be used for mineral khaki, it is not to be recommended. It is much preferable to use the chrome alum as obtained in the manufacture of Alizarin.

Alizarin is a derivative of anthraquinone, and this intermediate is always produced by the oxidation of anthracene. The oxidation is carried out by means of a bichromate, and consequently the waste liquors contain the corresponding quantity of chromium sulphate. Hence, Alizarin manufacturers usually treat these waste liquors so as to recover the chromium sulphate in the form of a chrome alum. And usually it is the ammonium chrome alum which is manufactured, and is sold as containing about 15 per cent of chromium oxide.

Chrome acetate, the other salt which is used in mineral khaki dyeing, is also valuable as a mordant in the printing of cotton fabrics. It is quite stable and is marketed in a crystalline form. On the other hand, chromium acetate can be fairly easily made, as required, from other chromium compounds.

In one method, a paste containing chromium hydrate is dissolved in just the necessary quantity of acetic acid. Alternatively, a solution of sodium bichromate containing acetic acid may be reduced with glucose. In the third method solutions of lead acetate and chrome alum, containing the equivalent amounts of these salts, should be mixed. Lead sulphate is thereby precipitated, and after allowing it to settle the clear solution containing chromium acetate may be decanted off. It will, of course, be evident that the solutions of chromium acetate prepared by these methods in which chrome alum is used will contain salts of the alkali metals, but for most purposes the presence of these is not objectionable.

Mineral khaki essentially consists of the oxides or hydroxides of chromium, iron, and sometimes copper. Chromium contributes the green, iron the buff and, copper the bluish green portion of this compound shade. In the process of dyeing, cotton fabric is first cleansed and is then padded in a solution containing usually chrome acetate or chrome alum, and pyrolignite of iron, and sometimes copper sulphate. Copperas may also be used instead of pyrolignite (acetate) of iron. The padded fabric is then partially dried and steamed, and is then passed through a boiling solution of soda ash, and is finally thoroughly washed and dried. For heavy shades, the process may have to be repeated several times.

The dyeing of mineral khaki is a process that requires great care, since stains, crease marks and mottled effects are very easily developed.

Owing to the extensive use of chromium compounds, methods for detecting and estimating chromium are of considerable importance. Thus the chromium content of an aniline black dyed fabric or of fabric dyed with mineral khaki is often required. Fortunately rapid methods for doing this are possible.

Generally, chromium can be most easily estimated when it is in the form of bichromate or chromate. Hence in devising methods of estimation, this fact should be remembered. For instance, if a piece of chrome mordanted fabric is under examination, it should first be ignited so as to destroy organic matter. The ash may then be dissolved in hydrochloric or sulphuric acids, the solution thus obtained should then be made neutral or slightly alkaline by addition of sodium carbonate, and finally sodium peroxide must be added until all the chromium present becomes oxidized to sodium chromate. If iron or copper is also present, these metals will be precipitated in the alkaline solution of the chromate, and can therefore be filtered off and separately estimated.

Analysis of Chrome Alum

In the analysis of chrome alum, chromium acetate or chromium sulphate, it is also most convenient to

first of all oxidize them to a chromate by means of sodium peroxide in alkaline solution.

However obtained, a solution containing a chromate or bichromate can rapidly be estimated by either of two methods.

In the first method, only a standard decinormal solution of sodium thiosulphate is necessary, and this is prepared by dissolving 24.8 grams of pure recrystallized sodium thiosulphate in water and diluting the solution to one liter.

The solution of the chromate should preferably contain about 7.5 grams of chromate (calculated as sodium bichromate, $Na_2Cr_2O_7.2H_2O$) per liter.

In a 400-cc. conical flask should then be placed 20 cc. of 25 per cent sulphuric acid, and then 10 cc. of 10 per cent potassium iodide solution. Immediately the chromate decomposes the potassium iodide and iodine is liberated. This is then titrated with the decinormal thiosulphate solution using starch paste as an indicator.

One c.c. decinormal sodium thiosulphate solution
= 0.00253 grams of Cr_2O_3
= 0.00497 grams of $Na_2Cr_2O_7.2H_2O$.

This method is simple and accurate.

The other method involves the use of a solution of ferrous sulphate, and this should be prepared by dissolving 7 grams of pure ferrous ammonium sulphate to a volume of one liter. Great care should be taken to avoid aerial oxidation of this solution, and it is preferable to use in its preparation water which has been boiled and to which 20 grams of concentrated sulphuric acid has been added.

In this process the chromate solution being tested should preferably be ten times stronger than that used in the previous method.

Twenty c.c. of the iron solution should be placed in a small conical flask with 100 c.c. of water, and into it from a burette should gradually be run the chromate solution. From time to time a drop of the liquid should be placed with a spot of a solution of potassium ferricyanide which is placed on a white tile, and when no blue color is thereby developed the ferrous salt has been oxidized to the ferric state.

After one or two titrations the exact amount of the chromate solution required to just completely oxidize the iron is determined.

Then the amount of chromium present can easily be calculated, since—

One c.c. of 0.7 per cent ferrous ammonium sulphate solution equals 0.0253 grams of Cr_2O_3.

The volumetric methods described above are quite as accurate and much more rapid than gravimetric methods in which the chromium is precipitated as the oxide or hydroxide by means of alkalies and is then weighed after filtration and ignition as Cr_2O_3.

Reaction of Chromium Compounds

Chromium compounds are easily detected, since when in the chromous state they yield a pale green precipitate when treated with ammonia. Further, such chromous salts can be easily oxidized by their strong yellow color and in being soluble to alkalies. However, when a solution of a chromate is acidified with acetic acid and a solution of lead acetate is added, then a bulky precipitate of yellow lead chromate is immediately formed. Finally, when any chromium compound is fused with sodium nitrate and sodium carbonate on platinum foil a characteristic yellow melt is produced.

Bichromates and chromates, however, are capable of being further oxidized to perchromates, and this property in some instances can be of considerable value. It can, for instance, be used as a means of detecting hydrogen peroxide, and also it serves for the detection of very small quantities of chromium.

Chromates

When a solution of a chromate is acidified with sulphuric acid and then a small quantity of hydrogen peroxide is added, the chromate is oxidized to a perchromate, and in consequence the solution becomes blue. Where very small amounts of chromium are present the color developed is, of course, very weak and might perhaps be overlooked. But this difficulty can be overcome by adding a small quantity of ether. The ether dissolves the blue compound, leaving the remaining aqueous solution colorless, and since it is also insoluble in water it forms a blue layer on top of the liquor. The ether can be evaporated to any desired extent at a low temperature, the blue color being thereby concentrated and rendered easily visible. As indicated above, this test may also be used for the detection of hydrogen peroxide.

Finally, mention should be made of an interesting method for detecting chromium in liquors which contain much organic matters or other impurities. Often, if the quantity of chromium present is small, chromium does not respond to the usual methods of testing. If, however, the chromium is brought to the state of an alkaline chromate (the addition of sodium peroxide may be necessary for this) and a strip of filter paper is allowed to hang partially immersed in the solution, the chromate readily ascends the paper by capillary attraction. The chromate is thereby largely purified. It is then merely necessary to wash off the paper thoroughly and test the wash liquors for chromium by the hydrogen peroxide method.—Dyer and Calico Printer.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE WARNING OF THE RUHR

IT was scarcely thought, even by the most sanguine, in the days when the necessity for insuring the presence here of a self-contained coal-tar chemical industry was being agitated, that the American dye industry would so soon have an opportunity to say, "I told you so!" And it is with no species of smug self-satisfaction, but rather with sincere thankfulness and a desire to point out the vital lesson of the Ruhr occupancy, that it is said now.

American importers of German dyestuffs to-day frankly state that they do not know whether future shipments of colors will be forthcoming or not—or if they are coming, what the quantities will be as compared to normal. Is it hard to imagine what the state of the textile industry, to say nothing of the other dye-consuming industries, would be to-day if it were dependent upon Germany for these necessities?

With the French in possession of the Ruhr district, and German operatives of the five great color works located in this section refusing to work for the French, while the latter in turn refuse to allow them to work for German interests, the question of the availability of German dyestuffs becomes something very much less than even a fifty-fifty sporting chance, and the color situation produced by the World War, so far as Germany goes, bids fair to be duplicated.

"The economic struggle between France and Germany," declared Dr. Charles H. Herty before the A. C. S. Northeastern Section meeting in Boston, in an address given more fully elsewhere in this issue, "will, in all probability, result in the cessation of exports of German dyes and other synthetic organic chemicals, just as the blockade of German ports during the Great War cut off all German chemical exports in 1916. Dr. Duisberg, a leader of the German chemical industry, plainly indicates this in a recent statement to a representative of an American newspaper. No official announcement to this effect, however, was necessary, for it was plain that with the Ruhr basin isolated, thereby cutting off the coal needed for power, and the essential raw materials; with transportation demoralized throughout the Rhine territory, which is the center of the dye and chemical industry in Germany, and, finally, with upset labor conditions as the result of French occupation, the crippling of the German chemical industry must necessarily follow unless reparations questions are quickly settled."

Even assuming that these questions can be settled in time to prevent the actual stoppage of German dye shipments to this country, the mere threat of such a thing would, in days now happily past, have produced a condition of excitement close to panic among dye consumers.

But there will be no panic and no suffering among this country's dye users, no matter what transpires across the water. Thanks to the courage of American dye manufacturers in the face of every conceivable kind of obstacle and hostile influence, and thanks to the wisdom of some of the wiser heads in Congress in preventing the removal of embargo restrictions while the dye protection issue was being settled, we now have an American industry of sufficient strength and capacity to take excellent care, in the main, of all domestic requirements. Perhaps only the American consumer himself can realize to the full just how convenient—to put it mildly—this is going to be.

There is little doubt about the seriousness of the situation abroad, but in case any more evidence should be needed it may be pointed out as distinctly significant that American dye manufacturers report a rush of inquiries from foreign sources, which indicates plainly that other dye-using countries do not intend to depend upon Germany for colors with which to carry on their textile industries.

Some have stated in the past that only a gigantic upheaval like the World War could cut off America from German dye supplies, and that there is no possibility of such another upheaval for years to come. The latter statement is probably more or less true; but it is of vital importance to realize anew what we are seeing demonstrated at this very moment—namely, that it does not take a cataclysm like the World War to upset the German dye industry.

Moreover, those who have studied the European situation are agreed that the Continent itself is a seething cauldron of hatred, bitterness, suspicion, jealousy and vindictiveness, and that a generation or more must elapse before this condition will subside sufficiently to justify any dependence on lasting tranquillity.

In other words, there is absolutely no guarantee whatever that when the present outbreak has quieted down there will not be more in future. Indeed, the chances are overwhelmingly the other way.

The lesson of this is so plain that it cannot be mistaken. America must not be dependent upon Europe for "synthetic organics" or any other necessities. To-day she is not dependent for her supply of dyestuffs and other coal-

tar products, and anything which in the slightest way threatens to jeopardize this independence must be treated as a national menace and dealt with accordingly.

American dye consumers had a bitter lesson, accompanied by many painful results, when the World War broke out in 1914. Once again that lesson is being read to us, this time without pain and in the form of a warning of what we may expect—or rather, what we may *not* expect—from Europe. That which we may not expect is anything like regularity and attention to business.

During the distressing dye shortage of 1915-16 it would have seemed almost unbelievable that within a few short years the time would come when news of another stoppage of German dye imports could be received rather as an interesting news item than as a cause for grave fears on the part of textile makers.

While giving thanks for the facts which make possible this equanimity, it will be well for our textile manufacturers and other dye consumers to bear in mind that this happy condition exists solely by virtue of the presence within our territorial limits of a self-contained dyestuff manufacturing industry, and that any matter which hampers the growth or threatens the permanence of this industry affects with equal force the validity of the insurance which the industry now carries for the benefit of dyestuff consumers.

A WASTED OPPORTUNITY

THE Second International Silk Exposition has come and gone, leaving in its wake, as before and as expected, a most vivid and lasting impression of the glory of color as applied to this Queen of Fabrics. Owing to its location in New York City, its wide appeal, and the excellent publicity which it received at the hands of the metropolitan dailies, its opportunity for creating this impression upon generous quantities of many classes of people was really excellent, and to the credit of the management it should here be stated that this opportunity was taken advantage of in a thoroughly competent manner.

In view of this it seems more than a pity that the American dye industry, thus provided with a golden opportunity to enhance its own prestige and to gain much in the way of added confidence, loyalty and esteem from its most important ultimate consumer, the American woman—that the American dye industry, we say, did not see fit to take advantage of its own opportunity in a manner commensurate with the potentialities.

If ever there was a chance to reach the general public effectively, make new friends, and drive home the message which dye manufacturers are always complaining they cannot "put across" without the inevitable interference and attacks of foreign propagandists, the Silk Show gave it.

And the sole response of the dye industry was a booth taken by the National Aniline & Chemical Company, a booth artistic enough and attractive to the eye, but a booth without attendants and without one visible effort to call attention to the fact that it was our much-maligned and still joked-about American dyes which made the gorgeous display of color possible.

As a persistent and active defender of the interests of the American dye industry, The REPORTER is at a complete loss to account for the reasoning which prompted the industry to turn down this chance. Perhaps it was not a positive process like reasoning at all, but a negative process, a failure to grasp the significance of the rich possibilities. If so, the American industry needs a reawakening.

Beyond a doubt the basis of the strong effect which the Silk Show exercised upon the minds of lay visitors, as well as the most lasting memory created, was the beauty of the colors. Those who look back upon a visit to the affair will remember, first of all, that it was harmoniously colorful. After that, as the mind seeks to recall details, will come remembrance of the varieties of hues and combinations of hues, the variety and quality of the fabrics themselves, the effective methods of display adopted, the mechanical ingenuity and technical knowledge which went into the making of the fabrics, the fashion pageants, etc. But you may depend upon it that the first and last mental picture will be of the colors.

Behold how good and excellent a thing it would be, then, if the fact that American concerns made those colors was bound up inseparably with this lasting impression!

The thing would have been very easy indeed for the dye manufacturers to have accomplished. The thoughts of the visitor were automatically turned toward color from the moment he stepped inside the door. At every turn he was tempted and beguiled to stop for closer scrutiny and admiration of fresh wonders of color, and his mind was quickly brought to a state of greater sensitiveness to color values and keener appreciation of the possibilities of color. And it follows that during his tour of inspection he became easily receptive to any facts or information about color.

The pity lies in the fact that no one said to him, while he was still in this state: "Now, see what your own American dye industry has done and is doing for you!"

Had this been the case the chances are that when at some future time someone thoughtlessly made disparaging remarks to him about American dyes—as people still do, from mere habit, along with the coal shortage, the help question, and the income tax—that instead of agreeing with equal thoughtlessness and passing on to something else, he would have said: "American dyes? What's the matter with American dyes, I'd like to know? Not a thing! You can't tell *me!* Why, say, you ought to have been at the Silk Show last February and seen—," etc., etc.

As a stanch friend of the American dye industry, The REPORTER is impelled to state its belief that the industry erred in not taking an active part in the Silk Show. It provided a perfect market-place in which to "sell" American colors to many thousands of people whose verbal

support would be exceedingly valuable. We are of the belief that the industry would reap more actual benefit from participation in the Silk Show than from a number of the publicity ventures which it has financed, and that it will do well to give this view serious consideration in the months to come.

Credit is due the "National" for its recognition of the Silk Show as a fitting medium for the display of a dyestuff manufacturer—in spite of the fact that even this enterprising producer apparently did not sense the educational possibilities of its presence in the midst of the most striking demonstration of American colors which the country affords.

And the remainder of our dye manufacturers let it be said, as has often been said before in these columns: The American public, and particularly the American woman, is of the utmost importance, now and in the future, where all questions of loyal support are concerned; its importance takes almost equal rank with that of the dye consumers, who, after all, will readily follow a public demand. Let no opportunity escape, therefore, to bring American dyes and their genuine worth to the attention of the American people, for once the patriotic pride of the latter is aroused they will never stand idly by and see our industry made such a political shuttle as it was in the very recent past.

Correspondence

AMERICAN DYESTUFF REPORTER,
New York City.

Gentlemen.—Your recent editorial of February 12 suggesting expressions from readers concerning the advisability of adoption by the dye industry of the Dr. Wilhelm Ostwald system of color measurement is at hand.

My limited knowledge of color measurement indicates that the Ostwald system (and especially one or two others) could be readily adjusted to the needs of the American dye industries, which needs are probably different, at least psychologically, from the needs of the German industries.

A venture to foresee the direction of adjustment of color measuring systems to American needs leads to the following topics:

1. An increase in number of standard shades.
2. Developments in use of light filters.
3. Adoption of highly developed spectrophotometric methods for refined work.
4. Improvement of present theory and language.
5. Protection of our words from foreign idiom.

Let me mention the significance of these items in a limited way:

1. The existing Munsell color system comprises about 500 color standards. These cover loosely the possible range of fast pigments and cost about $5.

A volume or card index of about ten times this size, made from Ostwald color lakes and closely covering the whole range of possible color, would seemingly be able to drive the Ostwald optical instruments from the market.

2. Regarding developments in the use of light filters, it seems likely in view of the physiological theory of vision that an instrument could be made which by the turning of three knobs would produce any one of a million shades of color, with its number correctly indicated on the dials.

3. Admittedly the Ostwald system is limited to one kind of light. For highly refined work involving a knowledge of color in all lights we seem to require a special system or systems. (Some are now in use.)

4. If there is a present prospect of rapid growth in the theory and language of color, it is an interesting question to decide if the new system will be sufficiently long-lived to justify the cost of its adoption. What is the present state of growth in theory and language of color?

5. The confounding of our language with foreign idiom might well be scrutinized. Is it truly good to have "dull" mean gray and "color tone" mean pure, bright color?

Undoubtedly the Ostwald system is a splendid development and well suited to the situation which Dr. Ostwald finds.

But would it not be well for us to assemble the leaders of all the different kinds of colorists in this country and adjust the system exactly to our own situation or needs?

Yours very truly,
(Signed) WALTER C. DURFEE.

PREDICTS STOPPAGE OF CHEMICALS FROM GERMANY AS RESULT OF RUHR OCCUPATION

AMERICAN TEXTILE INDUSTRY WILL NOT WANT FOR DYES AS IN 1916

Necessary Dyes Made Here

AMERICAN CHEMICAL INDUSTRY CAN NOW SUPPLY PRACTICALLY EVERY NEED, SAYS DR. CHARLES H. HERTY, ADDRESSING A. C. S. SECTION

"Fortunately for the American textile industry and and other users of dyes and synthetic organic chemicals, the most recent industrial development in the Ruhr Basin carries with it no alarm, for by virtue of the stimulation of the war period there now exists an American synthetic organic chemical industry in a position of sufficient strength to insure against any suffering through lack of foreign chemicals," said Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers Association of the United States, in the course of an address on The Present

Status of the American Synthetic Organic Chemical Industry before the Northeastern Section of the American Chemical Society held this month at the Engineers' Club, Boston, Mass.

"The economic struggle now in progress between France and Germany will, in all probability, result in the cessation of exports of German dyes and other synthetic organic chemicals, just as the blockade of German ports during the Great War cut off all German chemical exports in 1916. Dr. Duisberg, a leader of the German chemical industry, plainly indicates this in a recent statement to a representative of an American newspaper. No official announcement to this effect, however, was necessary, for it is very plain that with the Ruhr Basin isolated, thereby shutting off the coal needed for power, and the essential raw materials; with transportation demoralized throughout the Rhine territory, which is the center of the dye and chemical industry in Germany, and, finally, with upset labor conditions as the result of French occupation, the crippling of the German chemical industry must necessarily follow," said Dr. Herty, "unless reparations questions are quickly settled by France and Germany."

Pre-War Conditions Changed

The blockade of 1916 found the American textile industry in a very embarrassing position, for there was then in this country barely a few months' supply of necessary colors, and no factories, or even a nucleus of an industry prepared to make dyes and chemicals. These facts are too well known to need repetition here. The American chemical manufacturer can justifiably point with pride to the condition which exists to-day, with an American synthetic organic chemical industry ready to supply practically the entire needs of the country. As a matter of fact, the American consumer would scarcely feel the result of the complete stoppage of German colors, so well has the American industry progressed during the six years of its existence. The American textile manufacturer has perhaps not had it brought sharply to his attention how difficult a position he might find himself in within the next few months were conditions now as they were in 1916. Dr. Herty said he felt sure, however, that the textile manufacturer, in the background of his mind understood and appreciated the great benefits to be derived from mutual co-operation between his industry and that of the supplier of his necessary material, namely, the organic chemical industry.

Consumers' Co-operation

"We have abundant expectation of full and hearty support from consuming interests, for the testimony before the Ways and Means Committee of the House and the Finance and the Judiciary Committee of the Senate last year shows an absolute uniformity of agreement on the part of all consumers and importers that the industry should be protected by tariff duties, and high tariff duties. I believe that the time has now arrived when producers and consumers can join hands for mutual benefit in the continued development of our industry.

Prices Relatively Lower

"Let me give one example which is indicative of the savings which may accrue in all lines eventually. When we consider the increased cost of raw material and of labor as compared with pre-war figures, Sulphur Black and Indigo, two staple large-tonnage products, are selling at remarkably low figures, due entirely to efficiency in manufacture and keenness of domestic competition. German pre-war export prices of Sulphur Black and Indigo were 10 and 13 cents respectively, while the present American prices are 16 and 20 cents, a variation far less than the average index figures would lead one to expect.

Increased Stability

"This remarkable triumph for the American manufacturer, and others equally noteworthy, have been accomplished while the industry was facing an uncertain future. There have been two changes in conditions recently, which give promise of increased stability for the future: First, Congress has passed tariff legislation the clear intent of which was permanent protection for the domestic industry. A study of this legislation shows clearly that definite administrative regulations interpreted on the basis of the intent of Congress to give full protection are necessary. The Customs Division of the Treasury Department is working on regulations at the present time, and it is hoped that they will be thoroughly protective in character. In the second place, for the first time in tariff history, the act of 1922 gives to the manufacturer certain definite rights regarding protest in case he feels he is being injured through undervaluation. Fortunately, information necessary for guidance in determining whether injury is being done will be available soon through monthly itemized statements of imports to be issued by the Department of Commerce.

"It is a strange commentary that in 1831 the Friends of American Industry, assembled in convention in New York City, pled for just such information, and emphasized at that time the policy which Secretary Hoover has so constantly advocated, namely, that only through prompt and frequent publication of statistics on industrial matters could there be brought about that stabilization of industry which would protect both the manufacturer and the consumer against violent fluctuations, harmful alike to each group.

"Monopoly" Charge Laughable

"The past year has been a difficult period for our manufacturers. Along with every other kind of industry, they have suffered from the general depression in business. During the year the industry was subjected to a most searching investigation by a committee of the United States Senate on the charge of 'monopoly.' Laughable as this charge sounds to anyone who has given the slightest attention to the industry, nevertheless this investigation furnished the best of all means for combating the malicious propaganda which had sought to throttle the young but vigorous American industry. At its conclusion the chairman of the committee stated that not one scintilla of evidence had been presented supporting the charge.

Embargo Proposition Old

"Another worry which constantly overhung the industry during the past year was the uncertainty of the outcome of the efforts for legislative protection. Earnest efforts were made to secure the continuation of the selective embargo, which was being administered successfully and satisfactorily. These efforts were unsuccessful, but the industry has no apologies to offer for advocating this economic policy, for it had learned from history that it was the embargo of 1807 which transformed New England from a seafaring commercial section to our most vigorous center of industrial activity, and that further, when threatened with disaster from foreign imports, the cotton mills of New England in 1815 petitioned Congress to enact avowedly prohibitive legislation against imports of coarse cotton goods, which imports were threatening the very life of that industry, following the War of 1812.

Chemical Foundation Suit Political Diatribe

"To add to the trials and anxieties of our manufacturers during the past year, there came the sudden and unexpected suit of the Government against the Chemical Foundation for the return of patents seized during the war and sold to that organization. Proclaimed more like a political diatribe than a judicial procedure, the filing of that suit brought uncertainty as to the status of licensees who had invested large sums in manufacturing operations. As time has passed, however, assurances have been given that even if the Government succeeds in the suit, all effort will be made to protect the interests of licensees. On the other hand, the decision of Judge Augustus N. Hand in the case of Junker vs. Chemical Foundation, Inc., in the matter of infringement of patent rights on aeroplane parts, gives fair basis for the belief that the suit of the Government against the Chemical Foundation, which will begin on April 23, will be unsuccessful. It was an important point which Judge Hand laid down when he held in this decision that the Alien Property Custodian held these patents for the public good.

The Future

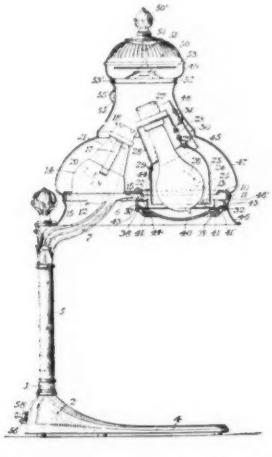
"We have confidence in the old adage: 'The darkest hour is just before the dawn.' Nineteen twenty-two was a period of stress and depression. The new year opens upon two avenues of co-operation which will lead the industry to permanent success; co-operation with the Government in carrying out the provisions of the tariff act, and co-operation with the consumer in supplying his needs to the very best of our ability at the lowest possible prices. With these doctrines as our basis for action, we face the future with a justifiable hope that we are now in position to advance rapidly to that stage of completion which will insure the permanency of the American synthetic organic chemical industry, thereby achieving the chemical economic independence of our country, for that independence is a vital necessity."

Recent Patents

Color Identifying Apparatus

U. S. 1,442,166; January 16, 1923. Norman Macbeth, New York, N. Y.

The apparatus described comprises an enclosure having disposed therein a source of ordinary artificial light, a light source giving equivalent to daylight, means supporting the said light sources, light reflecting means for the same, means for ventilating the said enclosure, means for evenly distributing the heat therein, and means for screening one light source from the other, hollow portable means supporting the said enclosure and electrical connecting and switching means disposed therein, adapted to alternately actuate the said light sources and cut the same



in and out of circuit and means to visually indicate when one or the other of the light sources is on.

Process for the Dyeing and Other Treatment of Textile Fibers in the Loose State

U. S. 1,432,318; October 17, 1922. John Brandwood, Thomas Brandwood, and Joseph Brandwood, Elton, Bury, England.

This is a process for treating textile material in the loose state, which consists in passing the material in compact form while held in a double conveyor over perforated surfaces located in the treating tanks, maintaining an air-tight contact between the material and the entire perforated surfaces thereby to prevent escape of air through any of the perforations without passing through the material, and causing a treating fluid to pass through the material and through the perforations in the surfaces over which it passes.

INQUIRY DEPARTMENT

R. M. H. Company.—*Question:* We are enclosing a sample of yellow dye. We have our own opinion as to what it is but would like to confirm it. We think it a direct dye masquerading as an acid color.

Answer: The sample you sent us is a Chrysophenine which, as you of course know, is a Direct Color. However, unless this color is sold as an Acid Yellow it cannot be claimed that it is masquerading as such a color, because Chrysophenine is quite often dyed with the use of acid, particularly on silk.

R. N. Company.—*Question:* We are enclosing herewith a piece of all-silk circular underwear cloth which has been dyed with Rhodamine in a fresh soap liquor and finished with Jersey cloth finish.

The goods were carefully inspected after finishing and were found to be satisfactory throughout. After they have lain for about a period of two weeks upon re-examining we find the yellow streaks to be present such as appear on the sample enclosed.

We would appreciate any method that you can suggest to remove these stains and if it is possible to give us an analysis of them we would like to know what you believe has caused this result.

Answer: In our opinion the material was improperly degummed previous to dyeing and the gum remaining in the material has caused the yellow streaks to appear after storing, although not apparent when the goods were examined immediately after dyeing. The material is somewhat more harsh in feel where the yellow streaks show, which would indicate the presence of some gum.

If the streaks are not due to improper degumming, we believe that they are caused by the presence of an impure finishing oil, which has caused the change in color.

We have been able to find no method which would remove the stains without affecting the color of the goods itself. We believe, however, that if you will boil off the dyed material in a neutral soap solution you will successfully remove the stains, after which the material can be redyed.

American hosiery, especially in the higher grades and more expensive qualities, enjoys an excellent reputation in Portuguese East Africa. American hosiery is normally sold through designated agents, but its popularity has caused the smaller shopkeepers, who are usually Indians, to secure stocks, which they sell fully 25 per cent lower than the prices quoted by the larger department stores.

The Childers Brothers Chemical Company, Lake Wales, Texas, has been incorporated with a capital of $10,000. Reuben R. Childers is president, George E. Childers vice-president and P. M. Childers secretary, all of Lake Wales.

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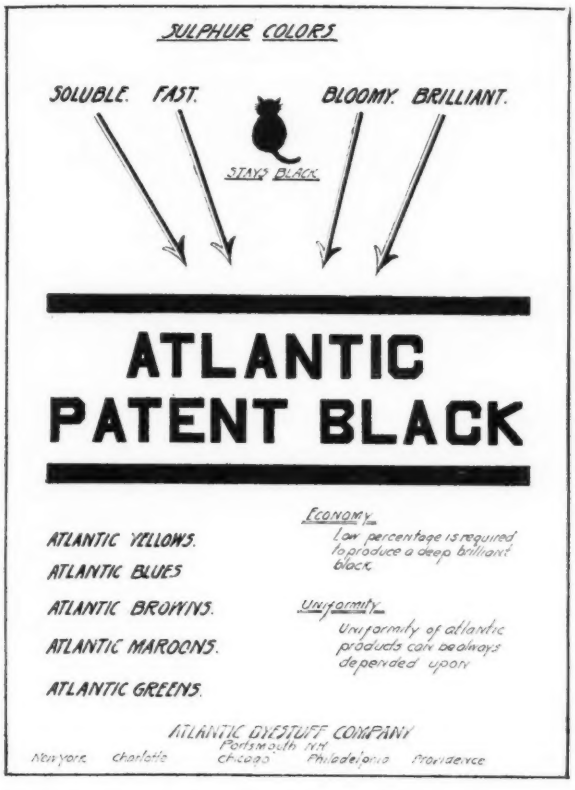

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